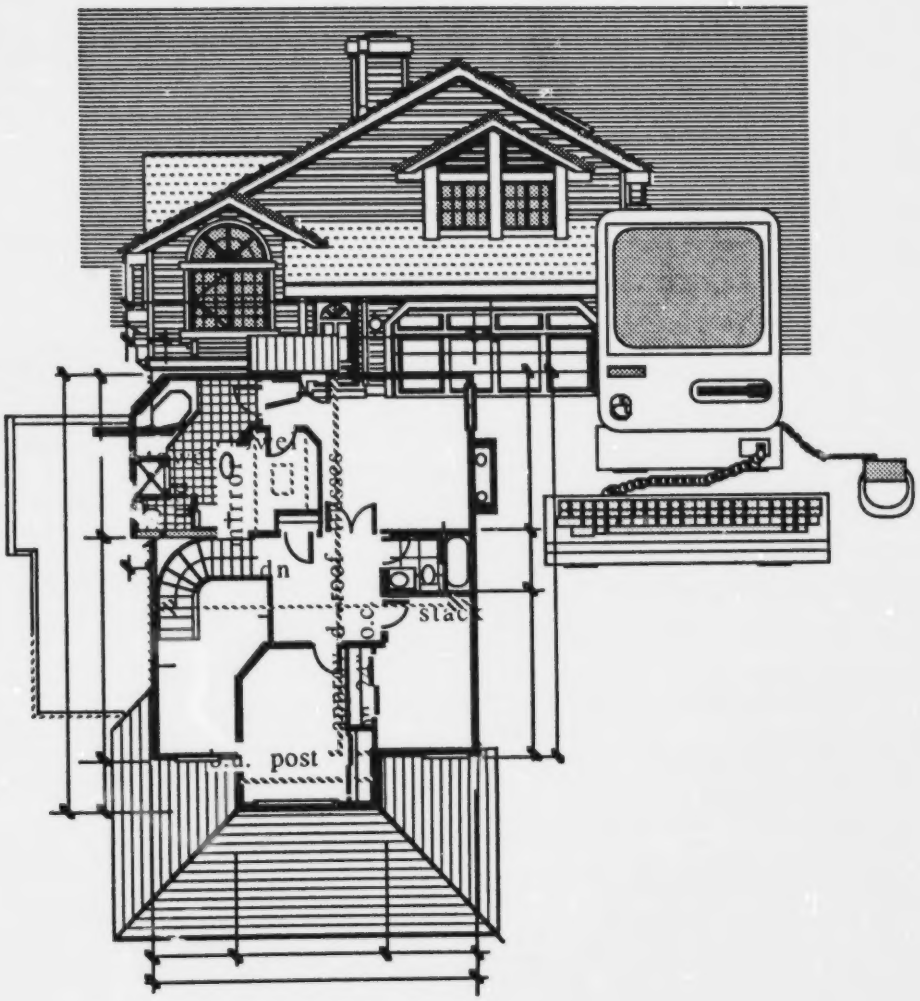
A NEW APPROACH TO THE DESIGN AND MARKETING OF HOUSING



Alberta
MUNICIPAL AFFAIRS
Innovative Housing Grants Program

A NEW APPROACH TO THE DESIGN AND MARKETING OF HOUSING

April 1986

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The views and conclusions expressed and the recommendations made in this report are entirely those of the author and should not be construed as expressing the opinions of Alberta Municipal Affairs.

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FOREWORD

The project documented in this report received funding under the Innovative Housing Grants Program of the Alberta Department of Housing. In May, 1986 the Alberta Department of Housing was amalgamated with Alberta Municipal Affairs which is now responsible for issuing this report.

The Innovative Housing Grants Program is intended to encourage and assist housing research and development which will reduce housing costs, improve the quality and performance of dwelling units and subdivisions, or increase the long term viability and competitiveness of Alberta's housing industry.

The Program offers assistance to builders, developers, consulting firms, professionals, industry groups, building products manufacturers, municipal governments, educational institutions, non-profit groups and individuals. At this time, priority areas for investigation include building design, construction technology, energy conservation, site and subdivision design, site servicing technology, residential building product development or improvement and information technology.

As the type of project and level of resources vary from applicant to applicant, the resulting documents are also varied. Comments and suggestions on this report are welcome. Please send comments or requests for further information to:

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The author of this study would like to thank the Alberta Department of Housing for the encouragement and in-depth support given during the field testing and preparation of this report.

The key to developing a system was the support and input of several small builders to offer testing opportunities. This entailed attending a number of show home sessions and working with potential customers, to see how sales staff could manage in terms of computer use. The builders involved were Ian Miller of Milham Developments Ltd., Tom Knott and Gary Mummery of Acacia Developments Ltd, and Jay Westman and Ted Kohut of Jayman Homes Ltd.

Many others gave input and provided valuable critical review during the series of workshops given by the Alberta Home Builders' Association in Jasper in 1985 and in Edmonton in 1986. Special thanks also go to the Calgary and Edmonton offices of Apple Computers Inc. for the loan of equipment and technical support.

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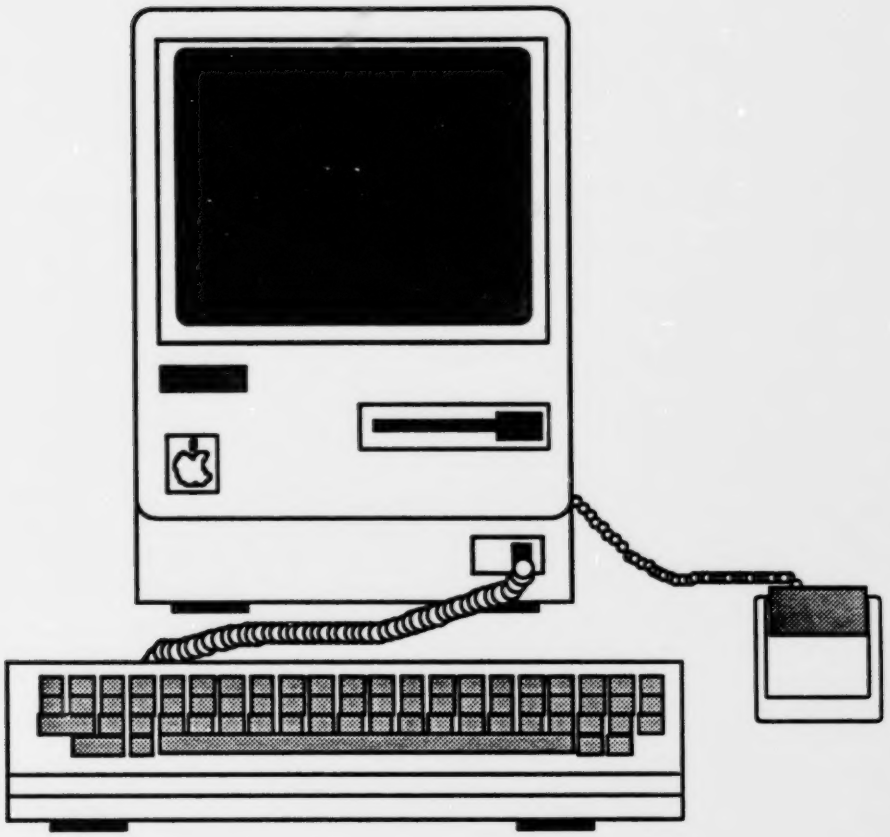


EXECUTIVE SUMMARY

1. THE OBJECTIVES OF THE PROJECT

The overall purpose of this report was to find new and innovative ways in which small home builders could better market their product, which would also improve the quality of their service to their customers.

The major objectives were to:

a) Develop a computer assisted marketing strategy for builders, using well established programs and with an emphasis on graphic presentation.

b) Develop a design and marketing approach which allows a higher level of interactive response and clearer communication between builder and home buyer related to design aspects and costing of alternatives, and in the preparation of the final contract documents.

c) Develop standard house plans and cost data bases using well established computer programs.

d) Test the new marketing strategy with several builders, and refine the approach where necessary.

2. THE APPROACH

The central focus of this study was a marketing and design approach using a micro computer system with well established graphic software applications, and other related software such as spread sheets, word processing and data bases.

Initially a review was carried out on what software existed, and would be suitable for this project.

The study was started by investigating how the existing home marketing process functioned and where improvements could be achieved with the use of micro computers.

Fig. 1. Demonstrating the System to Visiting Japanese Builders

In the next stage standardized drawing components such as staircases, windows, doors and furniture were prepared in a menu format that could be re-used on subsequent drawings, parallel with the development of standardized drawing techniques. A cost for upgrades was developed utilizing off-the-shelf spread sheet programs.

Next, plans and cost data from two builders were selected and fed into the computer, and a complete house design was prepared for a third builder. The solutions that were developed were then tested with two builders and their sales staff in real-life situations with homebuyers.

Reactions to this approach were requested from customers to test its validity and success.

3. THE KEY ISSUES RAISED IN THE WORK

The key issues raised were as follows:-

a) What parts of the existing marketing and design approach are capable of improvement?

b) What are the limitations of a micro computer approach, what level and type of equipment is required, and what cost is involved?

c) Are homebuyers interested in an interactive approach in which more solutions can be examined? Does it help them in the decision making process?

d) Is time saved?

e) What are the reactions to the approach by the builder, realtor and homebuyer?

f) Is the approach more profitable for the builder?

g) How can the computer-based approach be developed to have a significant contribution to the housing industry?

4. THE CONCLUSIONS

This study represents only a beginning in the development of a new marketing and design approach for the housing industry. However the initial lessons and experience gained provide a great deal of encouragement for further development and refinement. The testing was carried out during a period of major change in the computer industry, and further enhancements are already feasible.

The major findings were as follows:

a) The use of micro computers in both the drawing and calculation components allows much higher levels of interaction which contributes to the satisfaction of all parties.

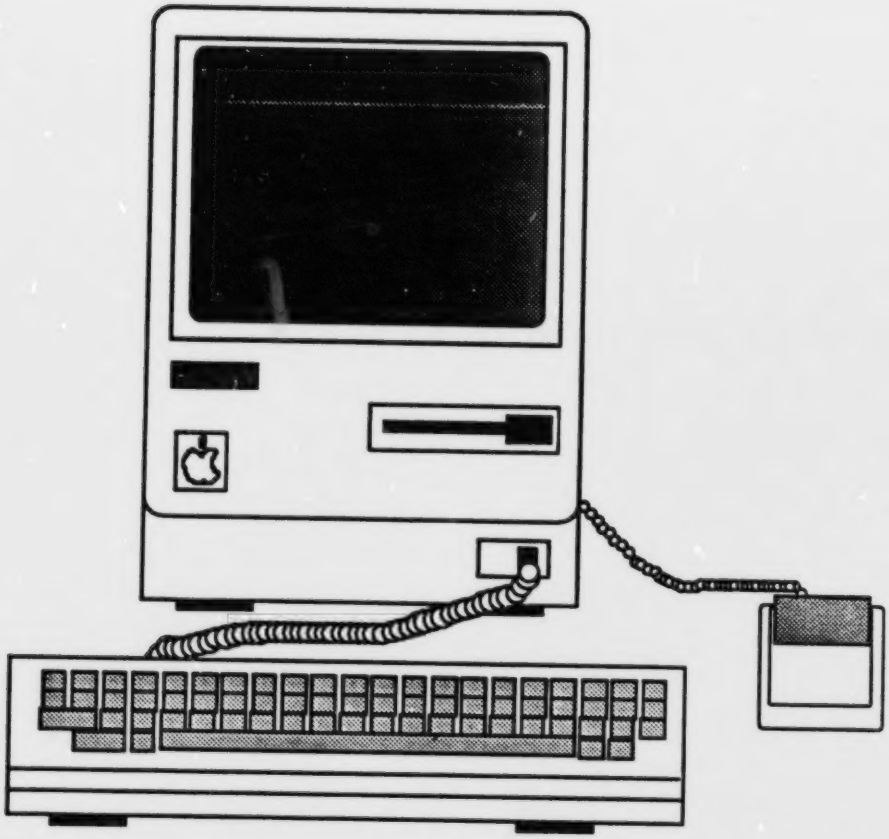
b) The computer can be productively used for both design and working drawings as well as a host of other functions in the sales and design process.

c) The system is extremely portable, allowing the sales and design process to be carried physically to the buyer.

d) A variety of printing techniques is possible including the use of matrix printers, pen plotters and high quality laser printers.

e) The major disadvantage of the computer system tested was the small screen size.

f) Some resistance by builders was also experienced because the Apple Macintosh system is radically different and non-compatible with other systems. Most Macintosh users seem extremely enthusiastic and satisfied with the system.



CHAPTER ONE

INTRODUCTION

1.1 AN OVERVIEW

Most people involved in the residential construction industry would agree that building techniques and the associated processes such as marketing, have undergone few changes in recent years. Progress in the development and use of estimating and accounting systems has improved and most builders now recognize the need for greater control of the financial aspects of their businesses. Many builders are currently considering the acquisition of micro computer systems.

At the same time the concept for a computerized approach to a variety of marketing and design issues related to the housing industry has been around for a long time. Unfortunately both hardware and software have either been too expensive or without sufficient power for serious use. The Japanese housing industry has perhaps been the exception in that considerable work has taken place with computerized techniques being used from the design phase right through to the finish of construction on site. Interestingly enough Misawa Homes of Tokyo have offered this concept to other smaller firms on a franchise basis.

The major issues with computers have been affordability, memory size, and disc storage capacity capable of dealing with the large amount of data storage required for sophisticated graphics and spread sheet programs. The early testing was carried out on an Apple Lisa 2/10, and It quickly become evident that the system had great potential for pulling together a number of ideas that had begun to evolve in revolutionizing the marketing and design process.

The early Lisa software had some "bugs", was slow, and the computers were too expensive. However the phrase "user friendly" evolved to describe it because of its ease of use, and lack of extensive and complicated documentation. The Lisa concept later developed into the smaller and more affordable Macintosh system on which the majority of work has been done for this study.

1.2 THE PURPOSE OF THE STUDY

The major purpose of this study has been the development of a new micro computer based home marketing system with participating builders utilizing the capability of micro computers and software. This involved the review of the existing marketing and design processes to ascertain the areas which are best suited to change.

1.3 THE PROBLEM AND ITS CONTEXT

The introduction of a computerized approach in any field has often not resulted in fast returns in either profit or in quality of service. The introduction of such techniques is very correctly viewed with some suspicion, especially when they are claimed to cure every conceivable problem.

Equally it has been rare that one computer system could serve all of the needs of any one industry even if cost was not a major issue. The rapid change in hardware and software also presents a high level of confusion, not least of all to the author of this study. During the course of this study, there has been a tendancy to be sidetracked by introductions of new software or hardware which might do a better job.

This study has placed great importance on finding solutions which are affordable particularly for the smaller builder.

1.4 SCOPE AND FOCUS

The scope was limited to the testing of one computer system, although other computer systems offer similar features. This was based primarily on the familiarity of the author with the Apple computer systems. It was considered important to establish a set of basic principles that could be applied to other systems as hardware and software continue to develop in

the future.

In developing a new approach to marketing and design issues the paramount requirement has been that experienced small companies be involved in the evolution process. Any new approach must be workable and affordable for builders of any size.

The overriding concern has been to limit the scope of this report to achievable goals which could best be demonstrated with detailed factual examples that were subjected to real life testing, rather than by a string of possible approaches, none of which would offer any real direction.

1.5 PREVIEW OF THE ORGANIZATION OF THE REPORT

The report is organized in six major components:

a) Chapter Two commences with a review of the existing marketing and design process, with identifiers where improvement can be made.

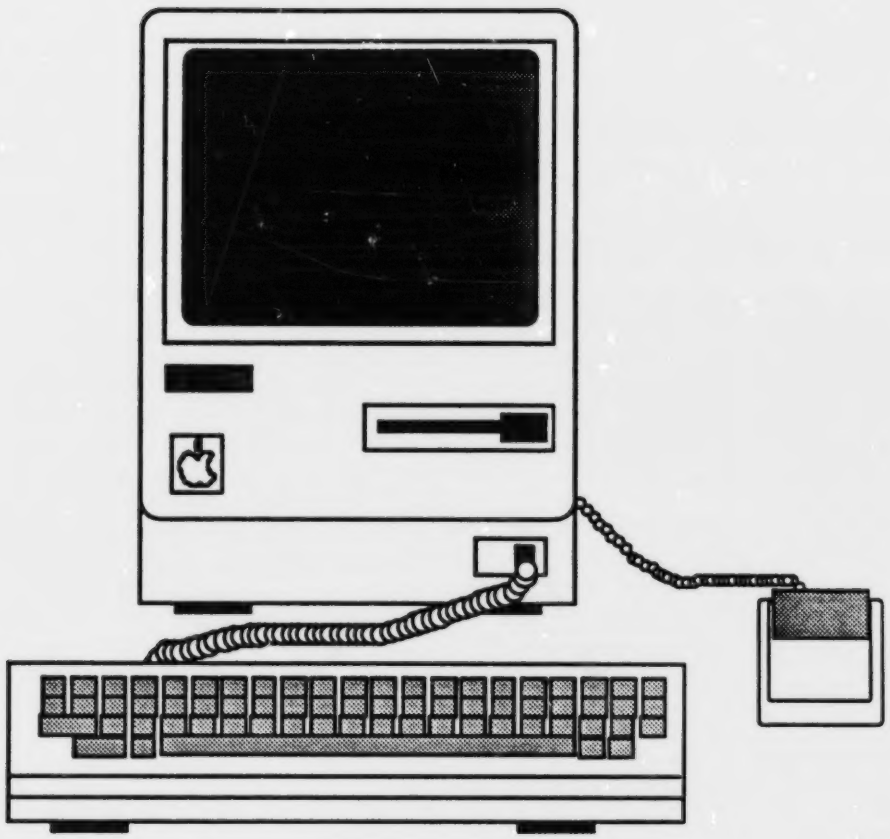
b) In Chapter Three the main elements in a computerized approach are explored in general terms.

c) Chapter Four deals with the specific elements that are suggested for use in the new approach.

d) Chapter Five is a review of case studies that were conducted in real life situations to test the validity of the approach .

e) Chapter Six evaluates the project and recommends refinements to the approach.

f) Appendix A is a review of computer equipment and software used in this study, with comments on how these have been improved, or if new items are now available.



CHAPTER TWO

EVALUATION OF EXISTING PROCESS

2.1 DESCRIPTION OF THE EXISTING PROCESS

In order to look for ways to innovate sales and design aspects, the obvious way is to review current practice and evaluate it before commencing any new approaches.

Generally the new home buyer has had little opportunity to be involved in the design of their home, nor have been able to make well considered decisions from the information available. This is strange when one considers the amount of money involved in a house purchase compared to other consumer items.

To some extent the level of input has been a product of the economic situation as a whole. When times are good the builder has tended to refuse to build other than the standard range of units, and when times are bad the builder is more likely to encourage change as a way to attract a greater share of a dwindling market.

2.1.1 THE SHOW HOME

The show home has been the main location for contact between the builder and potential customers, and is used for a variety of purposes. Theories have varied over the years that the showhome should be exactly the same as what the customer gets. Others will argue that the customer should experience more of a theatrical experience.

The major difficulty has been to show all of the design options that a realtor may need to secure a sale for specific customer needs, the speed with which such options might be reviewed, and at what cost.

Other issues such as showing available lots and the preparation of contractual information seem to generate considerable paperwork, and acts as a constraint in the existing process.

Certainly with the slow down in recent years, builders have been very willing to vary the design of their models to suit specific customer needs.

Some have used video recorders to show customers a wider variety of options from other homes that have been built previously.

2.1.2 THE ROLE OF THE SALES STAFF

Sales techniques will vary considerably with the particular sales person involved and the particular segment of the market being served. Successful and experienced sales staff have intuitively been able to recognize the potential for sales and have been able to direct the home buyer towards a successful conclusion.

2.1.3 DESIGN CHANGES AND THEIR IMPLICATIONS

With traditional methods the investigation of design options result in long time delays where the plans have to be changed. Alternative concepts that are tried using overlay tracing paper are often inaccurate.

Plans are taken back to the draftsperson and perhaps a week or two will pass before the plans are modified and revised costs are available.

2.1.4 THE COST AND ORGANIZATION OF UPGRADES

The process for change also takes place without proper access to all available information, and the investigation of alternatives is made very difficult, if the final cost is critical. Communication within the builder's own organization, especially where complicated changes in drawings and specifications are required, proves difficult to manage and execute in the field. What happens if the customer wants a kitchen from Plan B, a bathroom from Plan F, and a wet bar detail from another plan, and at the same time requires the relative costings? The result is likely to be full of confusion and has the potential for considerable misunderstanding at the construction stage.

2.1.5 THE SUBDIVISION PLAN

Records of available lots are generally maintained in a visual record displayed in the sales office. There is little opportunity to experiment with the lot layout and position of houses on the lot or to be able to explore the relationship to the adjoining lots.

2.1.6 PROMOTIONAL MATERIALS, ETC

The preparation and printing time for new brochures tends to reduce the flexibility that builders have found neccessary to stay competitive. At the same time it has not been possible to easily make any of the promotional or other documentation personalized to suit a particular customer.

2.2 ISSUES FOR AN IMPROVED APPROACH TO DESIGN AND MARKETING

Critical requirements for an improved approach are flexibility in dealing with changes in design, the need for more efficient ways of dealing with the contractual aspects, and the ability to have all of the relevant information available when required.

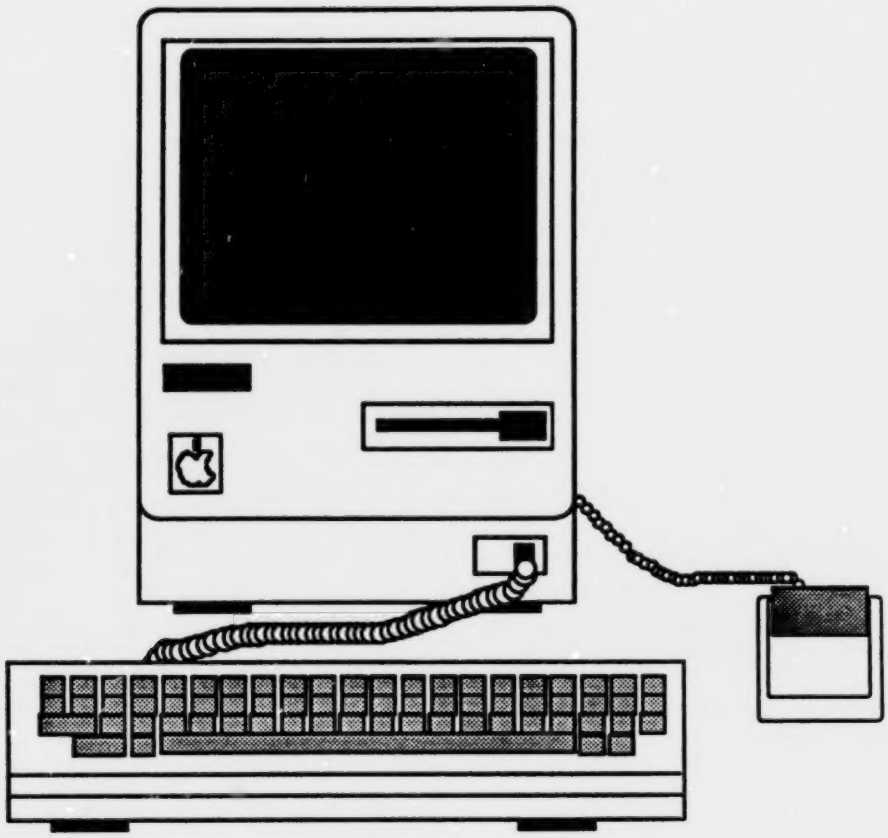
The major areas suggested for improvement are:

a) time requirements for making design changes;

b) the level of consumer-builder interaction during the design process;

c) limited availabilty of all information at the time of decision; and

d) the methods for recording of design and specification changes including the final contract documents, and a higher quality of printed output for the final drawings and documents.



CHAPTER THREE

DEVELOPMENT OF A NEW APPROACH

3.1 INTRODUCTION

A major issue to be determined has been how much of the sales person's traditional role can be changed with the introduction of a new approach to design and marketing based on computer technology. Will he or she wish to utilize any form of gadgetry, however useful, at the critical point of negotiating a sale? Will the introduction of new processes all take place after the point of sale merely to improve the communication within the builder's own organization?

To some extent a system has to be developed to suit individual needs, and it must be carried out without any undue or apparent delay, in order to detract from the essential focus of selling homes. Above all, the system must be flexible.

The value of a hi-tech approach must not be underrated. The public has become accustomed to hi-tech concepts and equipment in almost all aspects of daily living.

3.2 CAPABILITIES OF THE MICRO COMPUTER

The questions most often asked by builders are "What type of system should I buy?" and "Will it be able to serve me for a number of years without costly updates?".

In the past many computers have been able to deal with separate facets of this problem, but until the last year or so, no single computer could deal with all the requirements.

The work by Xerox Corporation in the late sixties and early seventies led to a new approach to providing a variety of solutions to both graphic and numeric demands in micro computer use, in a manner that was designed for easy and friendly use. Although Xerox did not continue with the development work, a number of the Xerox design engineers were recruited by Apple Computers Inc. to work on a new generation of micro computers. The initial result was the Lisa 2.0

computer which utilized a package of programs which simulated the every day work desk and tasks.

Plans and drawings could be inputed into the computer, changes could be carried out, and a variety of cut and paste procedures could be undertaken. At the same time there was access to high quality word processing, data base and spread sheet programs.

The concept later developed into the Macintosh computer and in a short period numerous new software packages have been developed which use a consistent approach of easy to use menu driven commands.

Fig. 2. Example of a MacIntosh Screen Menus

Simultaneously, the memory and disc storage capabilities have been significantly increased to a point where integrated applications of graphics programs and high quality spread sheet programs are feasible.

The advent of a Switcher program has allowed the user to simply flick between a variety of programs, and permit easy electronic transfer of numeric data, for instance, from a spread sheet to a drawing or to a letter or contract.

The computer has also become very transportable and easy to set up in new locations. This allows a salesperson to visit a homeowner with all the documentation and records in one place, and makes a showhome base less important.

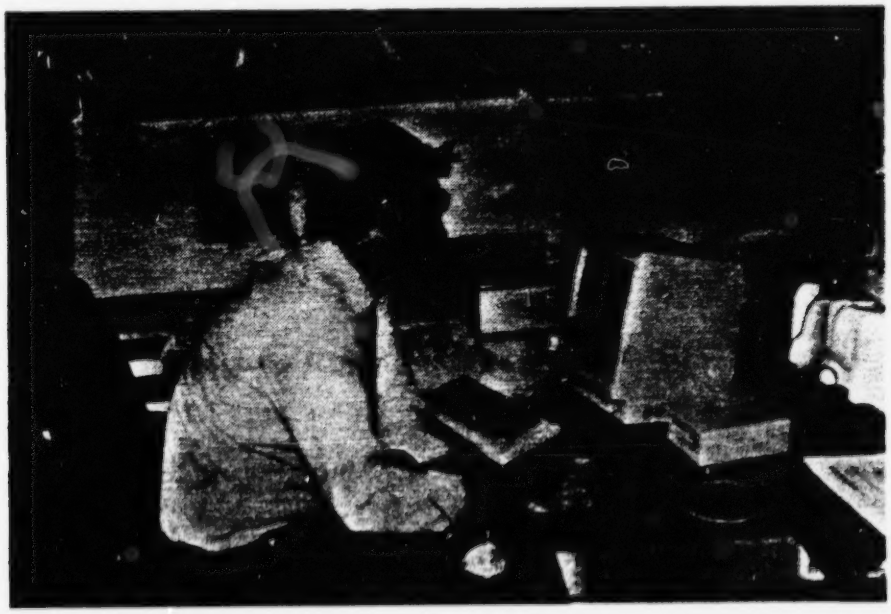


Fig. 3. The Basic Macintosh in Use

Screen size has been the main subject of criticism during the field testing of this study. It is simply too small for any more than two people to gather around. The older Lisa computer (which can still be used in the Macintosh environment) offers a screen size more than 40% larger, and is much more acceptable. The size of picture is very much linked to the amount of memory available and the resolution or clarity of the final image. External television monitors including projector units can be added to increase picture size although these still tend to relatively expensive.

The lack of colour has tended to be more of a perceived problem than a real one. The high quality black and white image is easy to use and colour can be used in several printing programs either with a mult-pen plotter or the Apple Imagewriter 2 printer.

By far the most important aspect of the system, and quite different from other computers is the way in which pictures are created and manipulated, especially the ability to overlap and "stack" images.

Above and beyond the work carried out for this investigation, the associated firm of Barry Pendergast Architect Ltd. has progressively introduced the same computer sytem into all aspects of this practice with extensive use in a variety of small to medium sized projects both residential and commercial. Each member of the firm works with either a Lisa or Macintosh computer carrying out a variety of drawing, administrative, and general office duties.

3.3 ROLE OF THE MICRO COMPUTER IN HOME MARKETING AND DESIGN

The role of the computer in the home building industry does not suggest anything that is entirely new. Rather it is proposed that it will be used to speed up the process, make it more efficient and provide a much higher level of service to the typical customer.

At the same time it is perfectly reasonable that the computer be used in any single application. This first application is more likely to be in a costing application, but those that have become familiar with the drafting programs will find it difficult to return to manual drafting techniques, especially when they are required to make changes.

What is a significant step forward is the capability of the computer to solve a multitude of different problems within a very short time period. This involves using the computer to tackle both graphic and numeric work.

The major areas in which the micro computer is suited to the sales and design process are as follows:

a) presenting high quality graphics capable of fast editing and change;

b) manipulating and calculation of large numbers;

c) testing many options, in both design and numeric terms in very short time periods; and

d) permitting electronic cutting and pasting of information between most types of documents, and the ability to print finished documents in a variety of mediums.

The portability of micro computers is also an advantage.

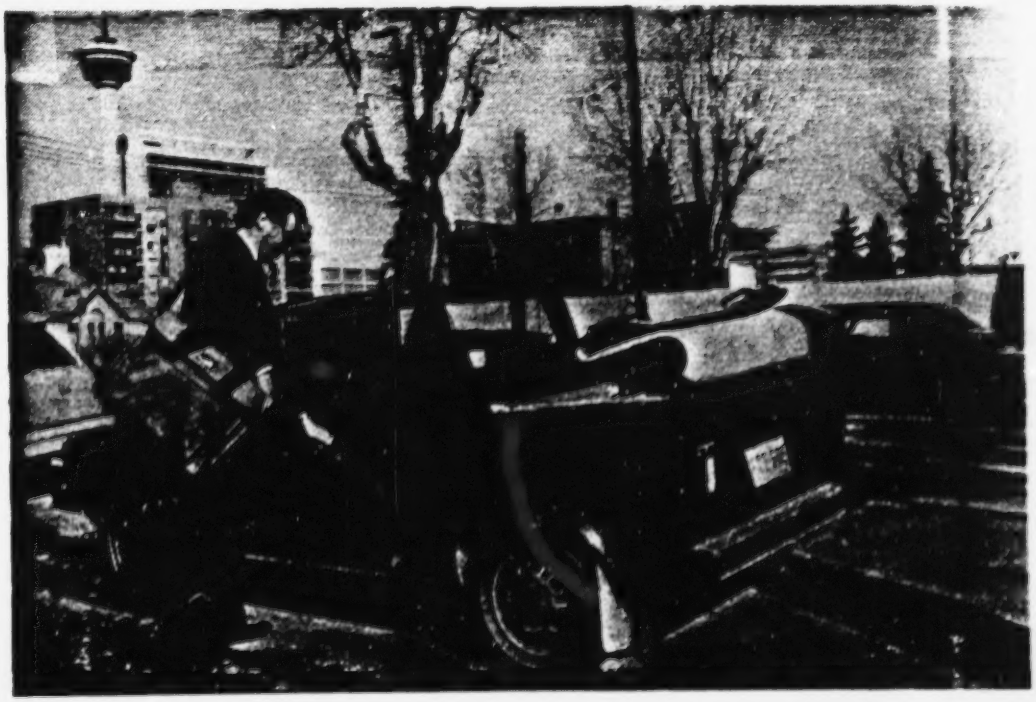
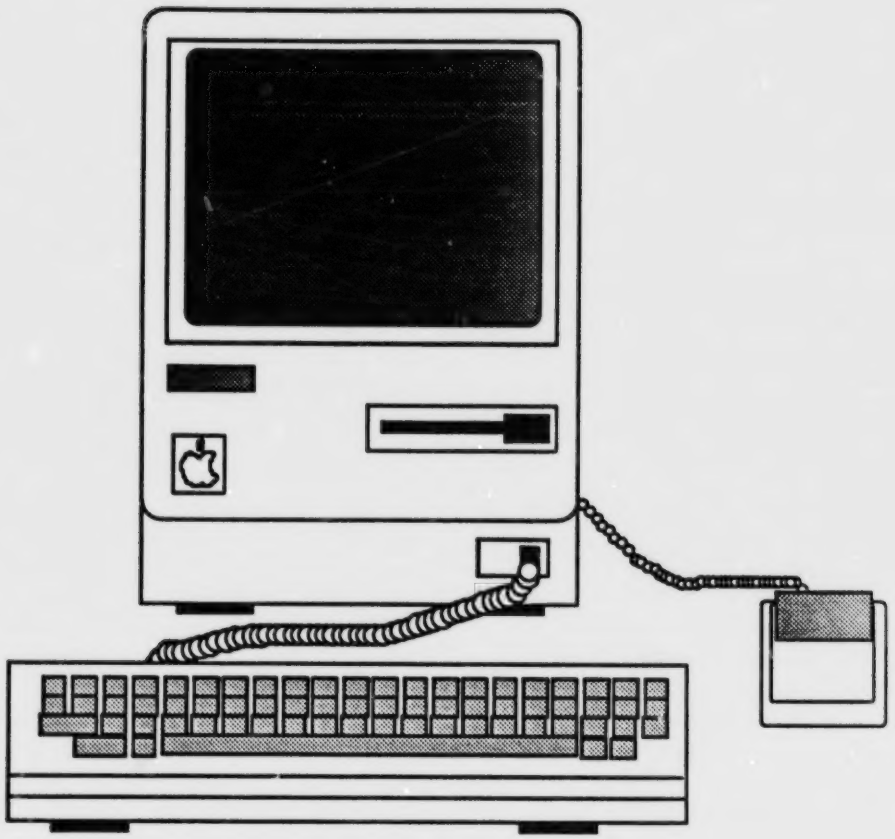


Fig. 4. The Portability of the Micro Computer



CHAPTER FOUR

ELEMENTS OF A NEW APPROACH

4.1 INTRODUCTION

In developing a new approach based on the computer, success will depend on the ability to combine the desired goals with the achievable capabilities of the computer. The main capability of this system is based on its ability to deal effectively with graphic images, make calculations and display numbers through high quality spread sheet programs, and deal with all images from any application in the word processor. Accordingly the key elements to the concept tested in this study are:

a) development of drawings and other graphic techniques;

b) development of spread sheet templates for costing of alternatives and applications such as lot inventories; and

c) review of other potential template and documentation formats.

4.2 DEVELOPMENT OF COMPUTER GRAPHIC APPLICATIONS

The investigation of the graphic implications and potential have formed the major part of this study. In part this is due to the author's occupation as an architect, but more importantly it is because all actors involved in the housing design and marketing process appreciate the significance of accurate, well-presented graphics in order to make a sale.

This part of the study breaks down into three major sub-elements:

a) the conversion of normal drawing techniques to the computer;

b) the use of more advanced concepts such as stacked options to assist in the selection of alternative design solutions; and

c) digitized techniques for inputting existing plans and graphic information.

4.2.1 THE CONVERSION OF CONVENTIONAL DRAWING TECHNIQUES TO COMPUTERIZED DRAWINGS

The computerized drawing programs used in this study are similiar to conventional techniques, but with all the elements such as paper, drawing instruments, scales, and drawing files built into the computer screen. Unlike other conventional computer-aided drawing systems (usually designed for mechanical drafting and adapted to the construction industry), the approach on the Macintosh more closely approximates conventional drawing, with a mouse controlled cursor acting as the pencil.

All command options are reviewed by pull down menus on the screen. Keyboard commands are optional and available for the more experienced operator.

The key stages in developing a computer drawing are:

a) To select a drawing size and appropriate scale (the drawing scale can be changed at any time so that either a drawing can be commenced at a larger scale than the final drawing or an imperial drawing can be entered and changed to a metric scale before completion).

b) To decide which elements can be drawn once and reused elsewhere on the drawing and which elements can be introduced from standard menu drawings. Care should be taken to add any new elements to the standard menus. A typical component menu is shown in Figure 5 on page 18.

c) To draw the walls of the building as filled rectangles (rectangles filled with a black shading), without any allowance for doors or windows. The use of rectangles for the main elements allows easy transition between scales.

d) To add windows, doors and other secondary elements on top of the walls. These elements incorporate a white rectangle or other appropriate shape to "open up" the walls automatically.

Fig. 5. Standard Construction Drawing Menu

e) Finally, lettering can be added by typing in from the keyboard. Lettering can be used in up to twenty font types with a variety of styles and sizes.

Accuracy is less than the traditional CAD systems, but is two to three times more accurate than standard drawing techniques, making the investigation of design alternatives very accurate.

The placement of furniture to establish the usefulness or practicality of a space is carried out using standard furniture modules or a customer's own units which can be quickly constructed on the screen. A typical furniture menu is shown in Figure 6 on page 20.

Fig. 6. Standard Furniture Menu

4.2.2 THE USE OF MORE ADVANCED CONCEPTS SUCH AS STACKED OPTIONS

The use of more advanced concepts such as stacked options as shown in Figure 7 to assist in selection of alternatives is discussed here.

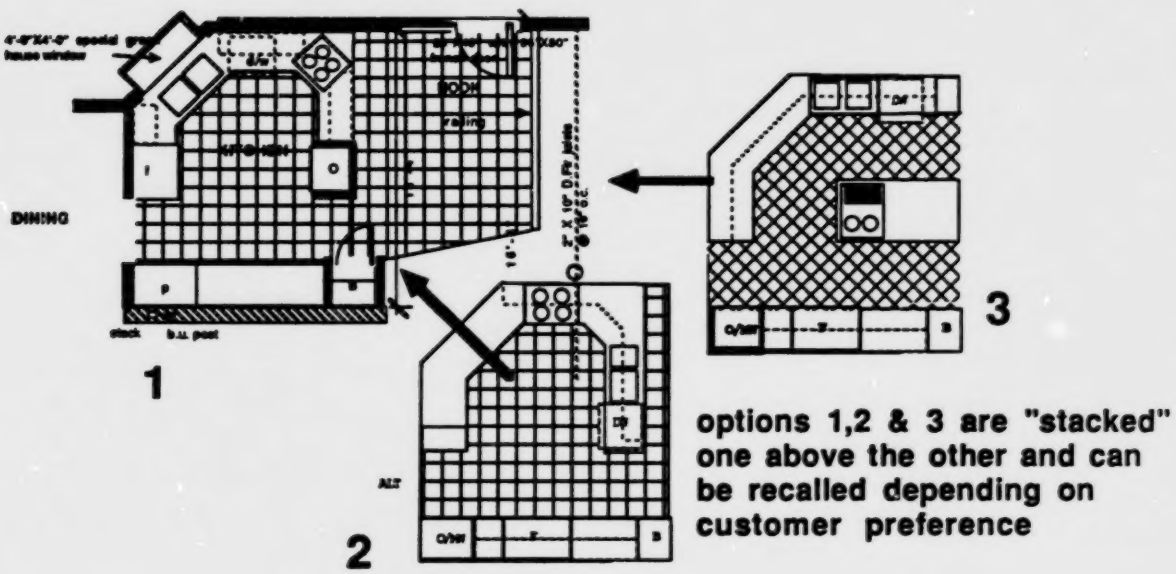


Fig. 7. Example of Stacked Options

As with tradional CAD layer systems in which various elements of a drawing can be placed in separate groups that can be added or deleted from the drawing, the Macintosh offers a potentially more powerful method of stacking options one beneath the other on any part of the drawing. Because the Mac images mask out images at the lower level, many options can be stacked in, for example, a bathroom or kitchen area, and simply flicked through to gain customer reactions. Whatever options show on the screen will be printed in the final document. This allows for a variety of options all in one place, and all on one drawing.

A more basic use is in the placement of windows, doors and other objects that might be moved. The use of a solid component allows it to be dropped onto a plan or elevation, with areas such as siding running underneath.

4.2.3 DIGITIZED IMAGES

One element of the computerized approach which is still undergoing development is the transfer of existing drawings or photographs into a format that can be used with the other program applications. This involves turning the existing document into a series of electrical impulses that can be read by the computer. Some units use a system based on a video camera while others use a form of low speed scanner.

During the testing period, a Thunderscan device was investigated for the digitized input of existing sketches and photographic data. This unit replaces the ribbon cartridge on the typewriter and scans the document at a relatively slow speed. The inputted image can be totally integrated and manipulated with most other programs in the computer. The use in renovation or modification of existing details is of interest where new ideas could be overlaid on the existing construction.

While the results were not considered satisfactory for current use from the point of view of resolution or clarity of the image, the concept is clearly one which will undergo considerable development in both quality and speed of use in the near future.

A local service company is about to offer a high quality imaging process which ties into the Apple Laserwriter printer, and is claimed to provide a high level of resolution in the final printed copy.

4.3 SITE ANALYSIS

While the interior of a home is often the major subject for design review at the sales stage, the consideration of external elements such as placement

on the lot to take advantage of factors such as climatic conditions and views is difficult with normal drawing techniques. Small paper models could be used but would be difficult to modify and almost impossible to record.

The computer allows very easy modification and movement of the house to suit a variety of needs. Details of adjoining units which have been sold can be included either on the computerized overall lot plan or in a spread sheet format for fast recall.

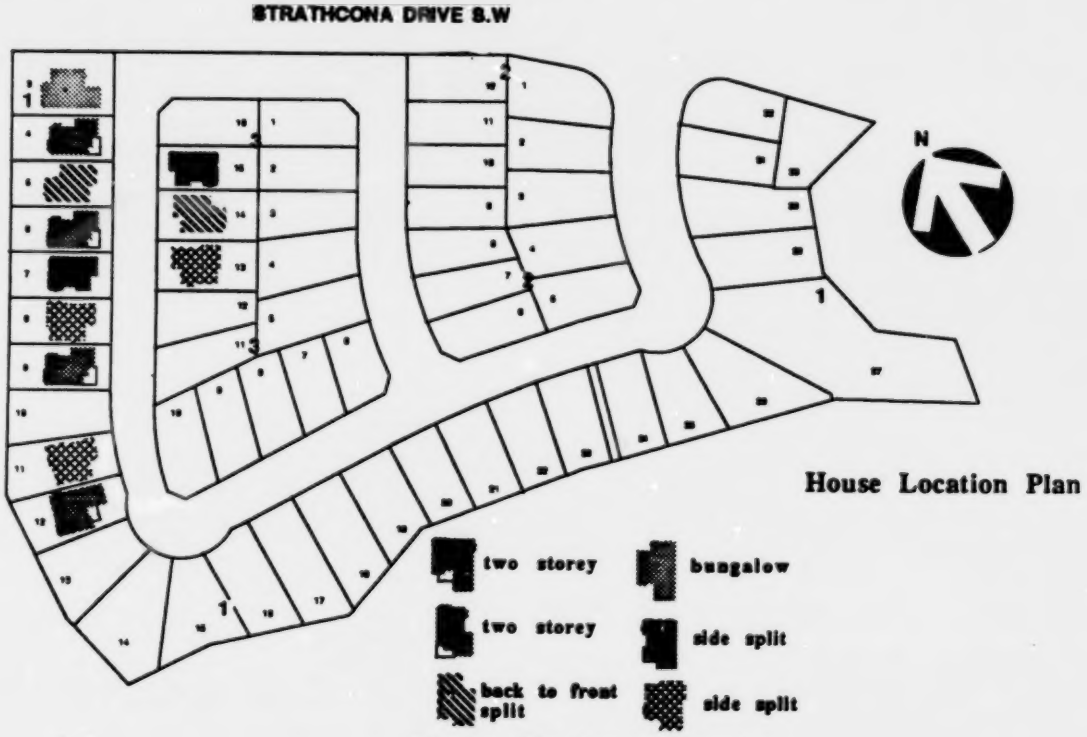


Fig. 8. Site Layout Drawing

4.4 ANALYSIS OF NUMERIC DATA - SPREAD SHEET APPLICATIONS

The introduction of low cost spread sheet programs for micro computers in the seventies perhaps was the single most important factor in the introduction of micro computers into the business environment.

In this study, two spread sheet programs have been used: Microsoft Multiplan and the more powerful Microsoft Excell. The main spread sheet application was used to determine the cost of variations in specification including the implications for monthly mortgage payments.

Using the Switcher program the computer screen can be quickly switched between a drawing of a house plan and the spread sheet costing program. Although changes on the plan are not as yet automatically transferred to the spread sheet, it appears feasible that some form of integration will be forthcoming in the future similar to the quantities type data bases available in other micro based CAD systems.

The cut and paste feature allows results of the final costed specification to be pasted onto the final agreed plan, thus forming a comphrehensive contract document.

The other major spread sheet application investigated in a preliminary form was a lot inventory system in which a bank of lots could be easily sorted by any criteria such as location, grades, suitability to house type, cost, aspect, views, etc.

Although the Excell program was only available towards the end of the testing period, it proved too large in terms of memory use in the 512K Macintosh for full integration with the drawing system. It quickly became apparent that it has the potential to be an extremely powerful tool in all aspects of costing or data manipulation.

4.5 THE INTEGRATED APPROACH

The Macintosh system offers many other levels of potential integration, since all of the programs work within a common approach and can take advantage of the ability to mix text and graphics into a single document. This might include the cutting and pasting of changes in specification onto the final drawings, or the total integration of all contract documents and drawings into one format. The concept can be further enhanced by using mail merge features to call various documents of both text and graphic

content into a single document specifically targeted to a specific customer request.

A possible use of this feature for a salesperson would be the virtually automatic generation of follow-up letters to positive customer leads at the end of each business day, and subsequently at regular periods thereafter. Such letters could include specific information relating to plans discussed, and more general information concerning topics such as overall subdivision data, community services, etc.

4.6 DOCUMENT AND HARD COPY FORMATS

For the production of hard copy there are a variety of output devices ranging from the Imagewriter which can handle all of the material up to a 15" wide format, a Laserwriter which can handle up to legal size of very high quality, and the plotter that permits a drawing of up to a 24" wide by 36" to be produced.

Most of the drawings for this report were produced on either the 15" Imagewriter or the Laserwriter. While there are slight problems in alignment for larger formats, both machines allow the drawing to be represented in any of the various tones and textures seen on the screen, and produced in a shorter time frame than the plotters.

4.7 FUTURE COMPUTER APPLICATIONS

The questions most asked during the study period by builders, architects and designers are listed below, along with their answers.

Q: "Does the system automatically change the cost estimates as changes occur on the computer drawing board? Will the computer produce material take-offs?"

A: Currently there are no linked drawing/cost estimate data bases for the Macintosh system, although the authors of Macdraft (the main

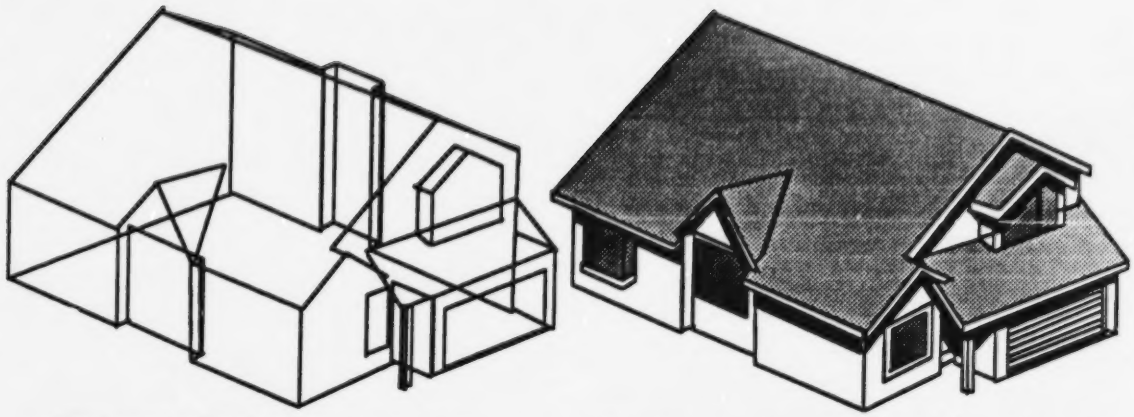
drawing program for the Macintosh) forecast program updates within the next six months that will record numbers of items appearing on the drawing and provide a level of manual area calculations. Alternative systems such as Autocad (a drawing program for the IBM computer) do have data bases that will handle the take-off of items such as doors, windows or other items, although it will not automatically handle changes in area calculations, and resulting costs.

Q: "Does the system automatically adjust structural details as walls and floors are modified ?"

A: To the author's knowledge there are no systems for general use that change the structural details as the layout of the building is modified. Certainly the process for manual on-screen investigation of structural requirements should not be difficult to achieve, although modification to local codes may be difficult.

Q: "Can you generate three dimensional images from two dimensional drawings?"

A: The idea of automatic generation of three dimensional images is an attractive one, but it is very difficult to obtain a reasonable image without first determining all of the x, y, and z coordinates for all the points of a building. This would entail a considerable extra work load in the initial stages. The Macintosh does have a powerful built-in three dimensional format that can be accessed by software. The results of a basic system developed by the author is shown in Figure 9 on page 27. There are at least three systems under development for the Macintosh which will make the generation of three dimensional images easier to obtain, although the degree of automation is likely to be limited. Generally the generation of wireframe images is much easier than images in which "hidden lines" are removed to make the drawing more realistic. Wireframe images can be used as a basis for later artwork.



COMPUTER GENERATED WIREFRAME

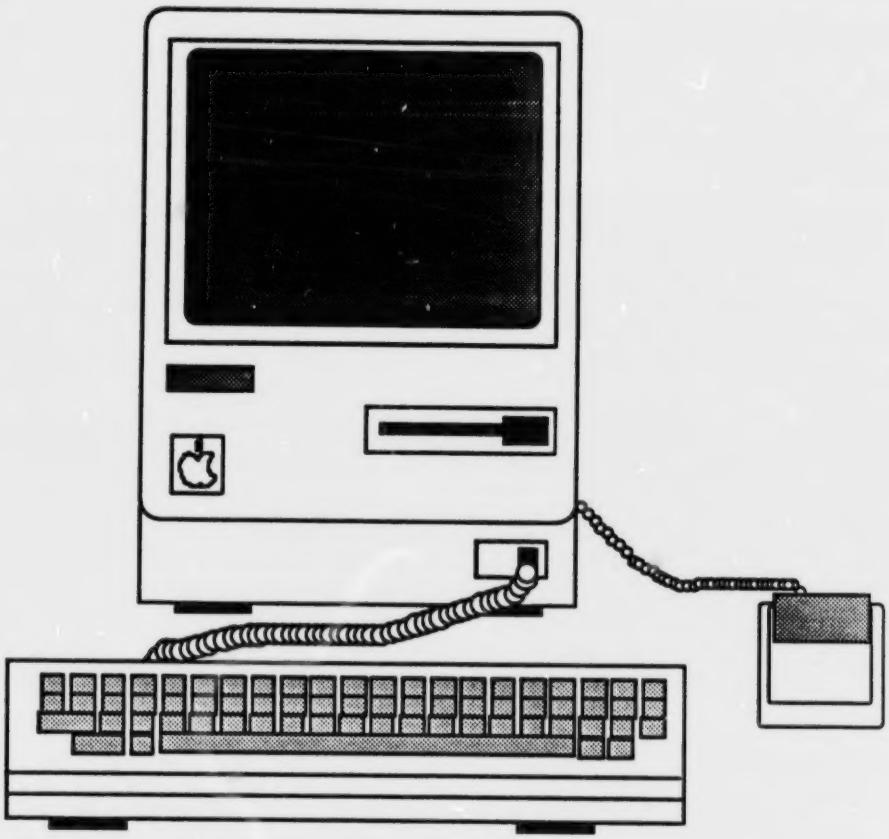
PARTIALLY COMPLETED SKETCH USING COMPUTER DRAWING BOARD

Fig. 9. Three Dimensional Wire Frame Sketch

Q: "How do I plot larger drawings?"

A: The question of plotting with the Macintosh has been one of the more difficult areas, in that only relatively small (in memory usage) drawings could be plotted on the larger roller driven plotters. A new program which does not rely on memory has been promised for release shortly to allow any size drawing to be plotted. The plotter, however, does not allow all of the textures and tones to be plotted, although these can be approximated with hatching and cross hatching. The plotter is also prone to pens drying up with consequent delays, and it is generally slower than the other methods of printing. Currently the printing of larger drawings using assemblies of smaller sheets printed on the matrix printer is the most convenient. However, some difficulty is encountered in matching up adjoining sheets.

The concept of an all electronic project also appears more feasible. This would entail the use of computers for every stage of the development, the electronic mail between builder and suppliers, the use of computers on the job site instead of sets of drawings, and the link with the approval authorities and financial institutions for immediate approvals and cash for advances.



CHAPTER FIVE

CASE STUDIES

5.1 INTRODUCTION

This part of the study provides the central focus in terms of the testing of the computerized marketing and design concept. Three building companies were directly involved in a variety of onsite tests.

The following examples represent the major case studies that were undertaken. The first study dealt with the complete design and preparation of working drawings for a custom home, all carried out solely on the computer. This was especially useful as a first test for the system since the sale of the home depended on a very short time period for preparation and approval of plans.

The second study involved the input of existing plans for a show home in the Strathcona sub-division in Calgary, Alberta and the subsequent modification of the plans for several specific homeowners.

Lastly a show home was visited on a regular basis to ascertain other areas where improvement might take place, in both the house designs and in the areas of computerizing costing alternatives and lot inventories.

5.2 CASE STUDY NUMBER ONE: THE WARRENS

The house designed for the Warrens in Strathcona was our first real test of the computerized approach to house design, marketing and construction. The front elevation as drawn is shown in Figure 10. on page 31 and the finished home in Figure 11. also on page 31. The house is now finished and the Warrens are happy with the way in which the computer allowed for determination of design decisions.

The program allowed only 10 days from start of design to finish of working drawings. This entailed constant meetings between the designers, the client and the contractor, Milham Developments.

Fig. 10. Warren House - Drawing of Front Elevation

The original design work started with Lisadraw on the Apple 2/10 Lisa, but with the arrival of the faster Macintosh the work was switched to MacDraw. The increased speed allowed a much higher level of interaction between the client, designer and contractor.

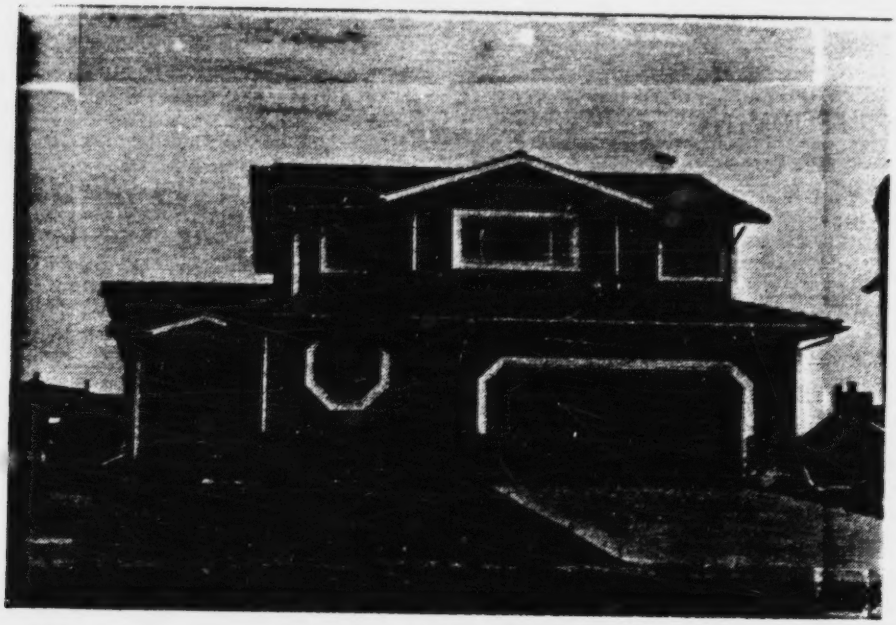
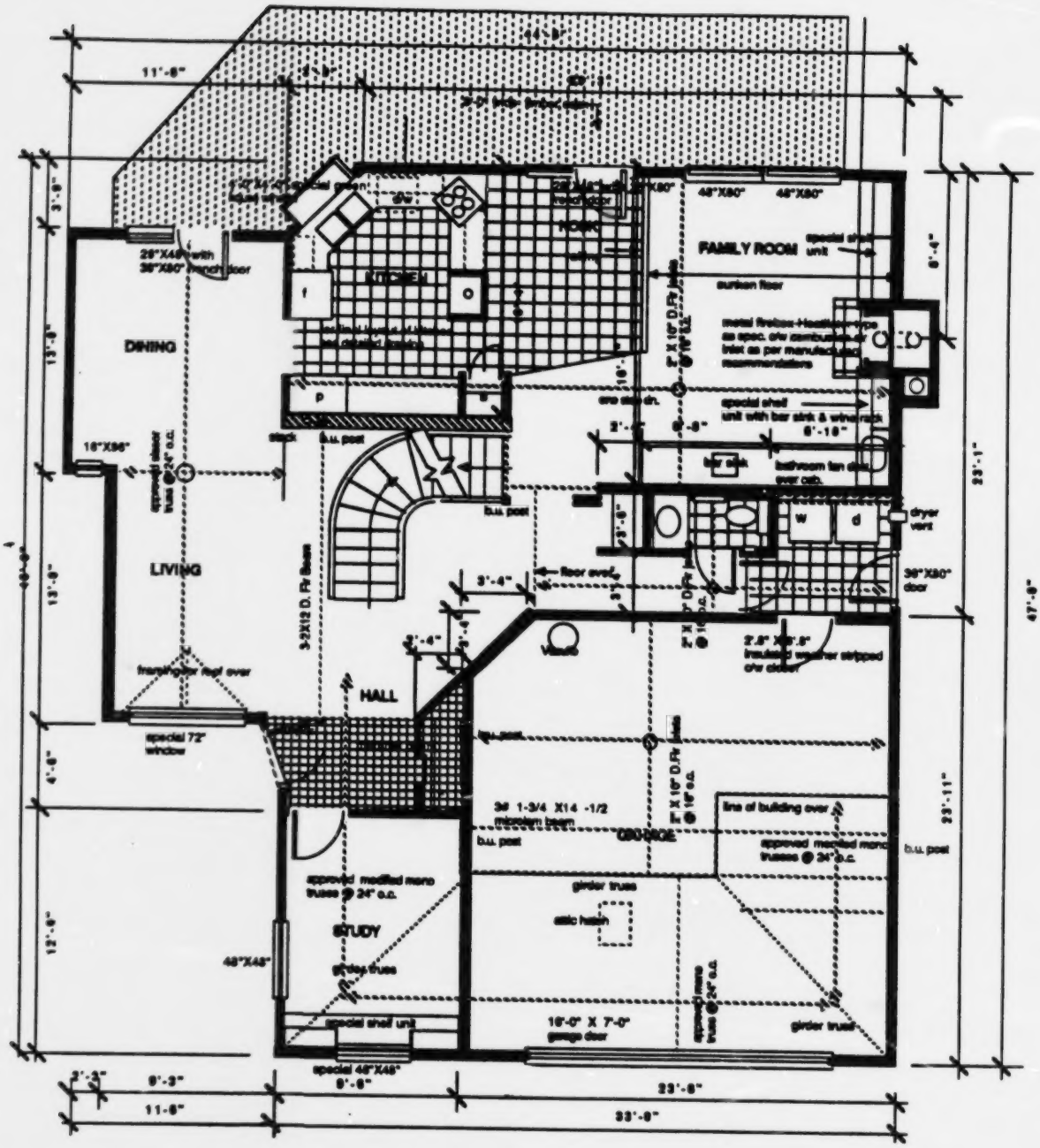


Fig. 11. Warren House - Finished



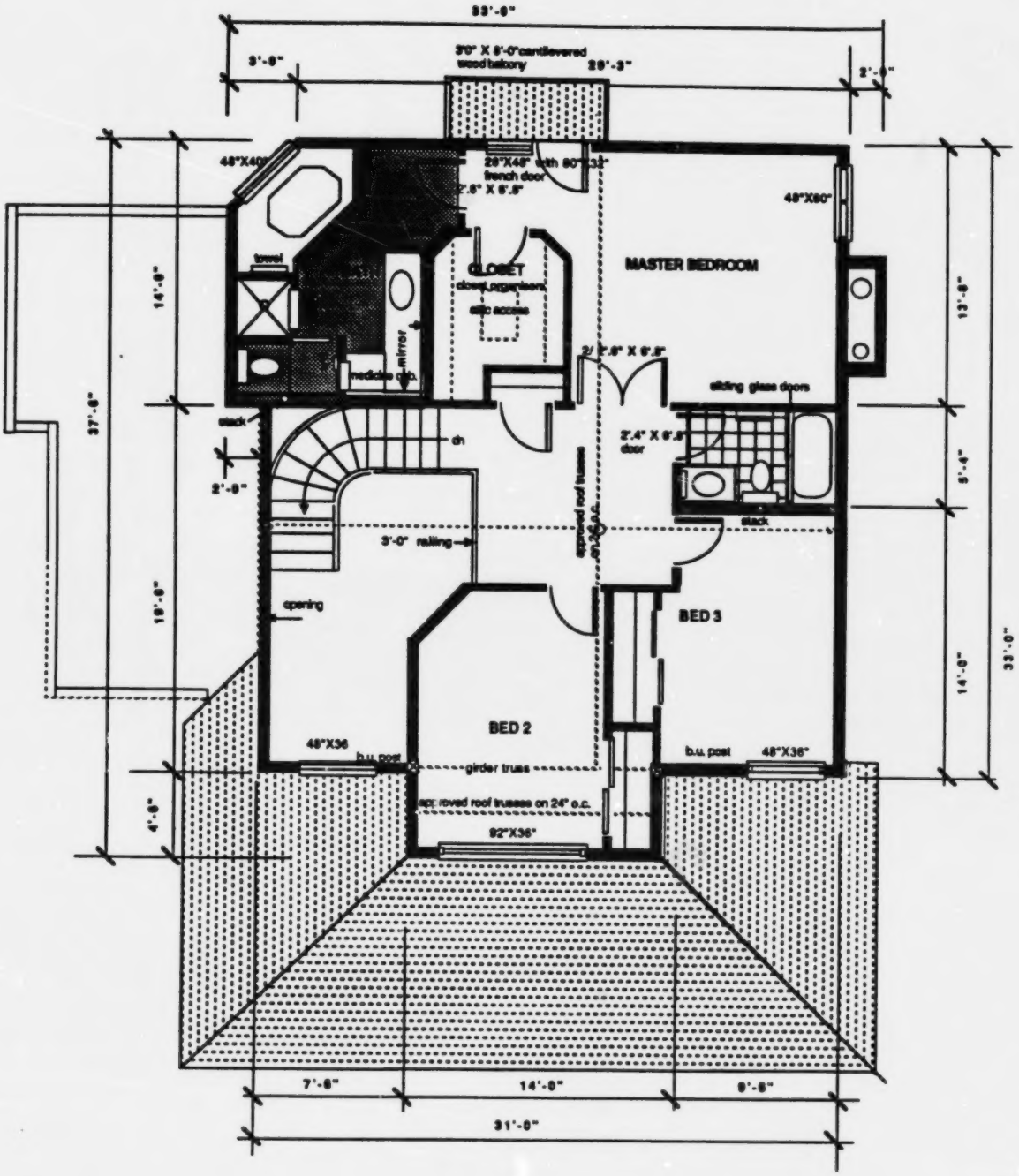
MAIN LEVEL

House designed specially for Peter & Linda Warren

MILHAM DEVELOPMENTS LTD

Barry Pendergast Architect Ltd.

Fig. 12. Warren House - Main Level Plan



SECOND LEVEL

area =

House designed specially for Peter & Linda Warren

MILHAM DEVELOPMENTS LTD

Barry Pendergast Architect Ltd.

Fig. 13. Warren House - Second Floor Plan

There was considerable dialogue regarding the kitchen (see Figure 12. on page 32) and master bathroom design (see Figure 13. on page 33), and many options were investigated because of the ease of use of the computer.

The original furniture menu was created for this home and permitted a much better appreciation of the spatial potential for the design. The clarity of the computer drawings also helped, although some degree of difficulty was (and still is) experienced due to the small size of the Macintosh screen. This to some extent has been corrected by the recent introduction of Lisa computers converted to a Macintosh environment, which gives a screen size that is approximately 40% wider .

5.3 CASE STUDY NUMBER TWO: ACACIA HOME

The design of the Acacia home represents an attempt to utilize the major features of a side split home on a relatively narrow lot, but with an unusual and pleasing relationship between the upper dining kitchen area, and the lower level family room.

The house was chosen for this project for the unique nature of its design and its potential for adaptability. The base plan is shown in Figure 15. on page 37.

The first design test involved plan modifications for Mr. and Mrs. Larry Kerr (see Figure 16 on page 38) in which major changes were made to the location of the master bedroom and the replanning of the laundry room area in the basement. The changes to the plans were made by Tom Knott and Barry Pendergast, without the Kerrs present. There were three sessions in all at Future Visions' office, none taking longer than an hour, resulting in finished drawings at the end of each session.

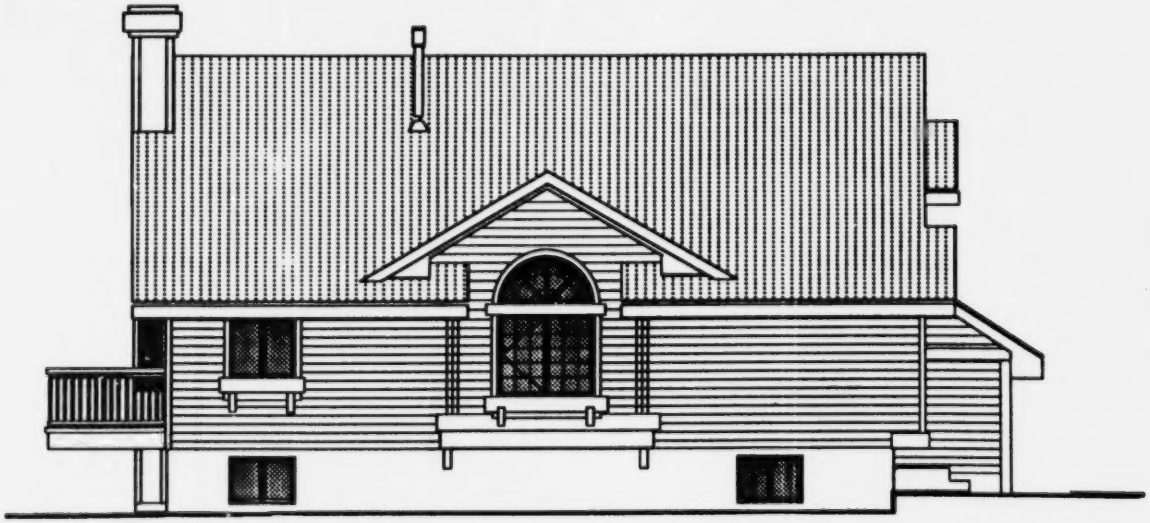
In discussions with Frank Godwin and Kent Terry (the sales people acting for Acacia), their view was that the use of a computerized system would be best utilized in close cooperation with the builder once a positive customer had been identified. There was concern that the use of a computer would distract the development of a relationship between realtor and potential

customer. To some extent this view may have been based on the fact that the realtors were acting for a number of builders from a central location. The use of a completely different sales approach for one builder could have been detrimental to all concerned. Overall the experience in this case tends to endorse this approach, especially for the initial introduction until all the limitations of the system have been analyzed.

The second major test in this session focused on the basement area where a number of options were tested with extensive use of furniture layouts. Attention was switched between the basement plan and elevational treatment to ensure all aspects of the design were fully considered before a final decision was made. Interestingly enough, the design involved greater expenditure than originally intended because the advantages were made much clearer graphically both in the layout and in the external appearance. The final elevation is shown in Figure 17 on page 39.

FRONT ELEVATION

REAR ELEVATION



LEFT SIDE ELEVATION

Fig. 14. Acacia Home - Elevations

Fig. 15. Acacia Home - Floor Plan

Fig. 16. Acadia Home - Plan Modified for the Kerrs

Fig. 17. Acacia Home - Elevations Modified for Tom Hall

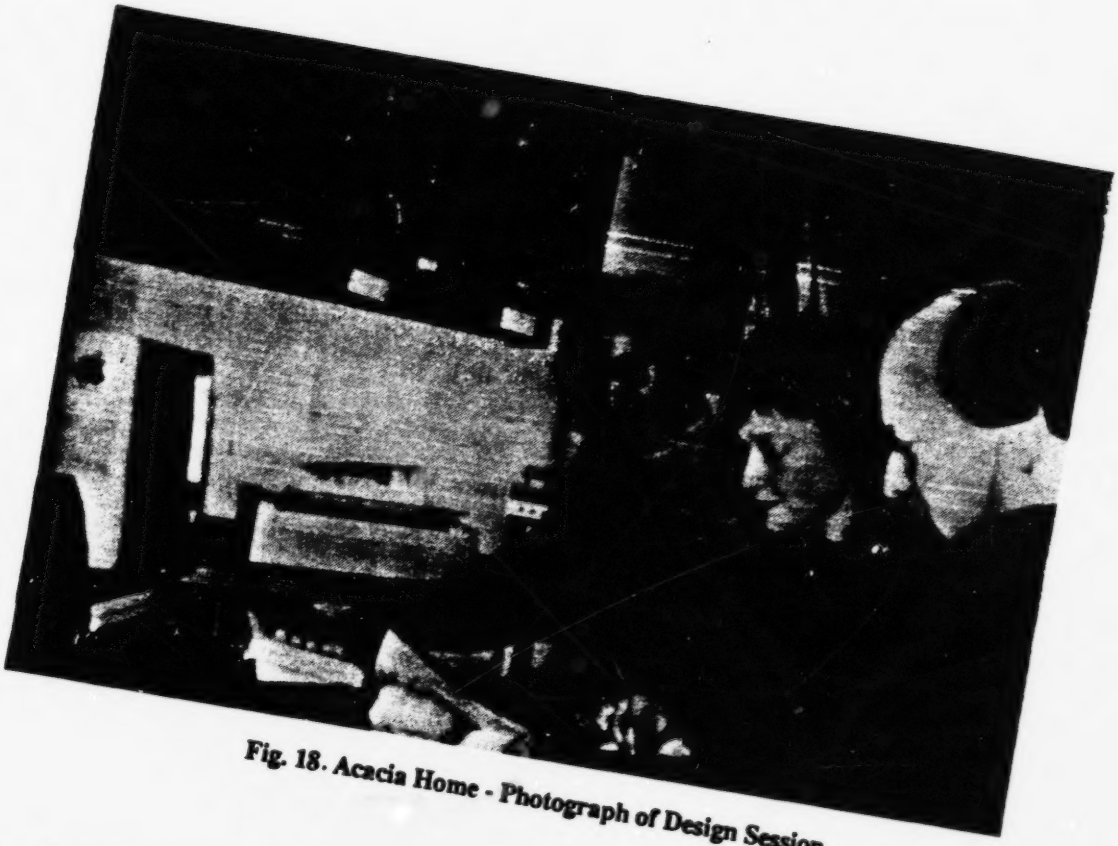


Fig. 18. Acacia Home - Photograph of Design Session

5.4 CASE STUDY NUMBER THREE: JAYMAN HOMES

This case involved significant input by the salesperson and his customers who worked with the author over a period of four three hour sessions in developing a number of potential solutions suited to the microcomputer in dealing with the day to day problems encountered in a show home environment. While few requests for any design change investigations occurred during these sessions, significant insight emerged on the most appropriate type of computer services which would benefit the front line sales staff.

The area which causes most difficulty by far is the coordination of client changes in layout and specification agreed upon at the contract signing stage. Currently, with relatively minor changes, a rough sketch is prepared in the sales office on tracing paper and copies are circulated to the head

office for costing, and to the trades for construction. Considerable movement of paper and data is involved and, as one would expect, there is the potential for mistakes in the transmission of data, and resultant errors on site.

The drawings prepared also indicate the ease with which drawings which are essentially working drawings can quickly be turned into drawings which have a high degree of appeal, and can be more readily understood by potential homeowners.

The small Jayman graphic was introduced into the drawings by the use of a Thunderscan digitizer which inputs original drawings into the computer in a form that can be used by all the other programs in the Macintosh. As yet, the quality of the final drawing is somewhat limited by the amount of memory available. However the unit is low in cost and can be used as a means of getting at least a base sketch into the computer.

Some degree of development was done on providing a complete system of dealing with changes, and communication between the home owner, the realtor, the head office staff and the trades. The ability of the system to mix graphic, numeric and text data allows a very high level of coordination, especially if linked with phone/modem connections.

At the more everyday level the system can allow the realtor to better monitor potential customers and keep in touch with their needs. This may involve sending standard format letters at the end of each day, which can be easily personalized to suit particular customers needs in a variety of ways.

The design changes investigated mainly revolved around the lack of market targeting in the single storey show home itself. The original design has a master and second bedroom at the ground level, with a study and loft at the upper level. Customers requested three bedrooms at the ground level or the moving of the master bedroom to the upper level as shown in the sketch.

A further option was prepared for an elderly couple who requested just a

single level version. None of the options have to date led to any sale.

One exercise carried out for Ted Kohut was the modification of elevations to remove a number of the costly rounded windows and similar features. The reason for the exercise was to make the particular house type as cost efficient as the competitors' homes. The exercise took less than half an hour and proved that the strong form of the original design was not negatively affected by the suggested change.

Major input was contributed by Jayman in testing a costing solution in which a variety of specification options could be investigated at the touch of a button, with the immediate impact seen on the final cost and mortgage payments. The recent introduction of MicroSoft's new Excell Program has greatly increased the capability in the area of costing alternatives.

Figure 21 on page 45 shows a chart of cost comparisons between two major types of specifications possible for the Princeton House type.

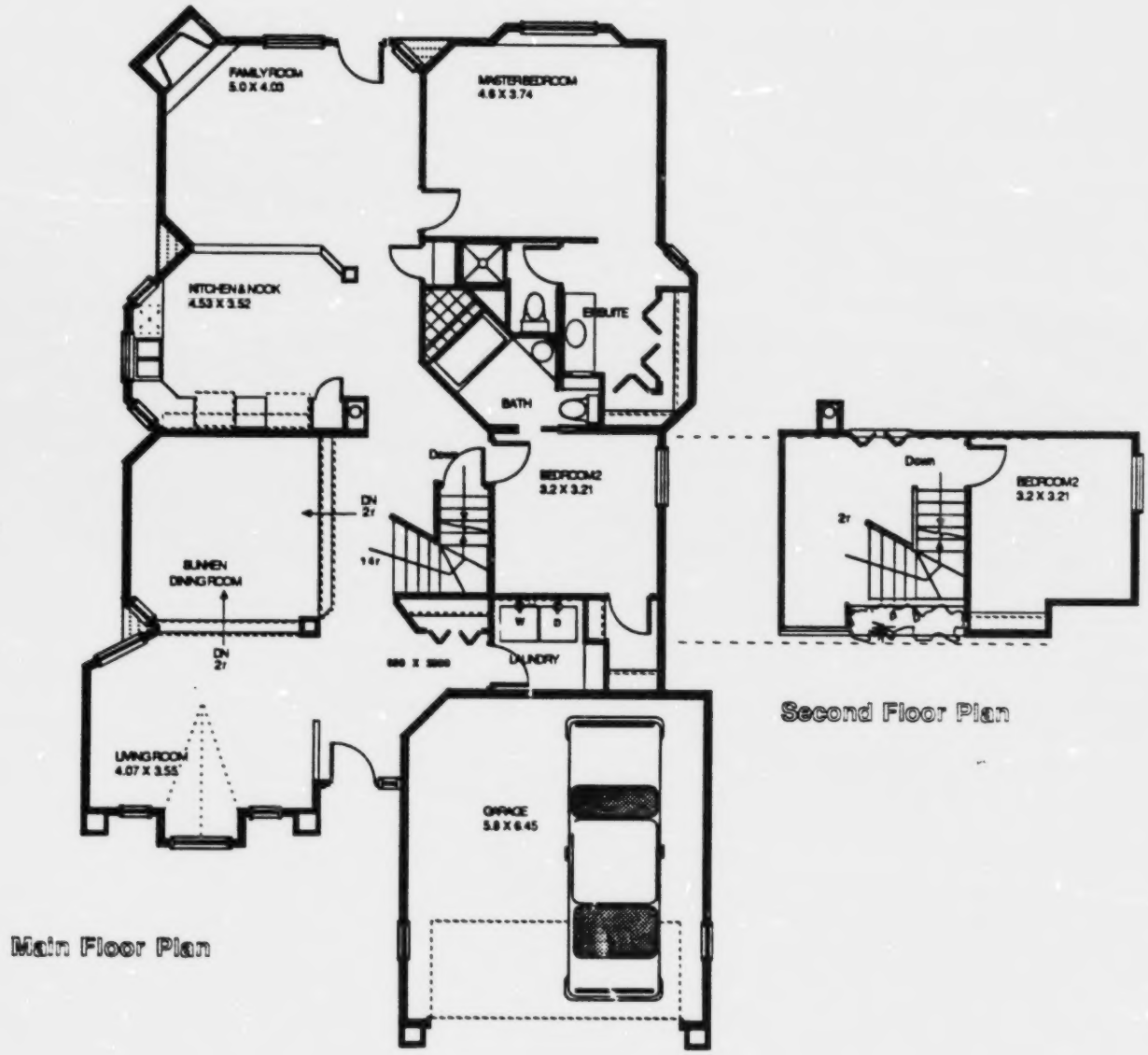


Fig. 19. Jayman Homes -Option A
Main and Upper Level Floor Plan

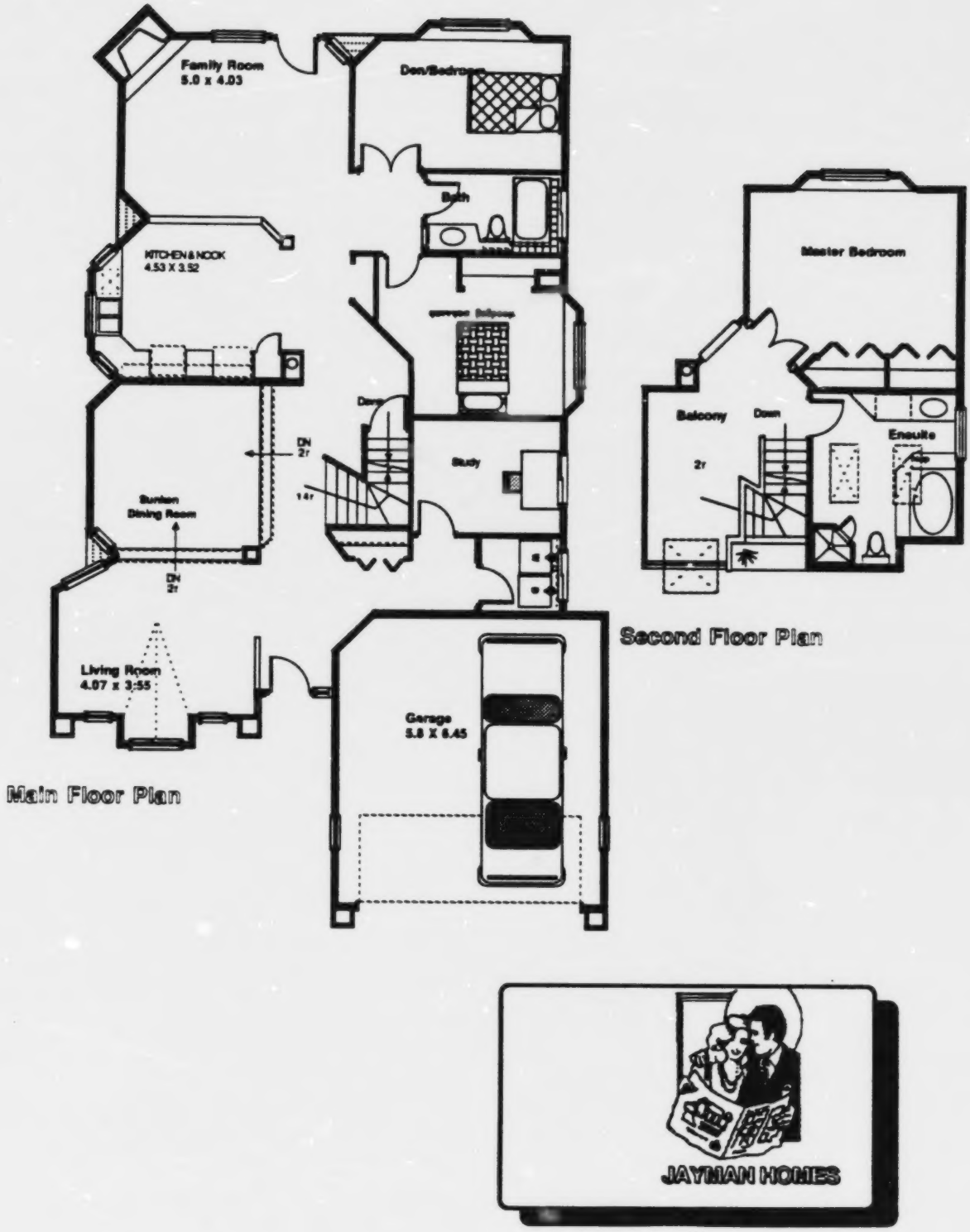


Fig. 20. Jayman Homes - Option B
Main and Upper Level Floor Plan

this is the summary of the house costs including extras, cost/sq.ft. and P.I.T

TOTAL COST MODIFICATIONS		$6360.00
BASE PRINCETON - ELITE SPECS		$91950.00
NEW PRICE OF REVISED PRINCETON		$98310.00
LOT PRICE		$29750.00
OVERALL		$128060.00
COST PER SQ.FT	AREA=1648SQFT	$59.65
MONTHLY P.I.T		$1463.62

CLASSIC	COST	ELITE		
RECESSED PANEL/MIRROR	$380.00	MOULDED DOORS		$0.00
CUSTOM CASINGS	$275.00	STANDARD CASINGS		$0.00
OAK SPINDLES/BRASS	$385.00	STANDARD MAHOGANY	*	$385.00
BRASS &CHROME WALTEC	$200.00	MOEN TARA	*	$200.00
ENERGY EFFICIENT FURN/	$450.00	STANDARD FURNACE		$0.00
R12-PLOY PANS&PILOT S	$100.00	R8 INSULATION	*	$100.00
POLISH BRASS HARDWAR	$125.00	AMEROC HANDLES	*	$125.00
SUNSHINE CEILING	$450.00	SWEDISH FIXTURES	*	$450.00
BRASS EXT. LIGHTS	$50.00	COACH LIGHTS		$0.00
TRIM BATTENS	$350.00	SIDING	*	$350.00
BRASS FIREPLACE DOORS	$145.00	SCREEN	*	$145.00
WINDOW GRILLS	$380.00	DELETED	*	$380.00
BOARDERED CEILING	$125.00	STIPPLE	*	$125.00
GALLEY RAILS & PURSE S	$200.00	STANDARD TRIM	*	$200.00
TRIPLE FACIA	$50.00	SINGLE FACIA	*	$50.00
MARBLE VANITIES/BANK	$100.00	STANDARD MARBLE	*	$100.00
FEATURE FIREPLACE WALL	$25.00	STANDARD 1/2 HT	*	$25.00
TOTAL:	$3790.00	TOTAL EXTRAS		$2635.00

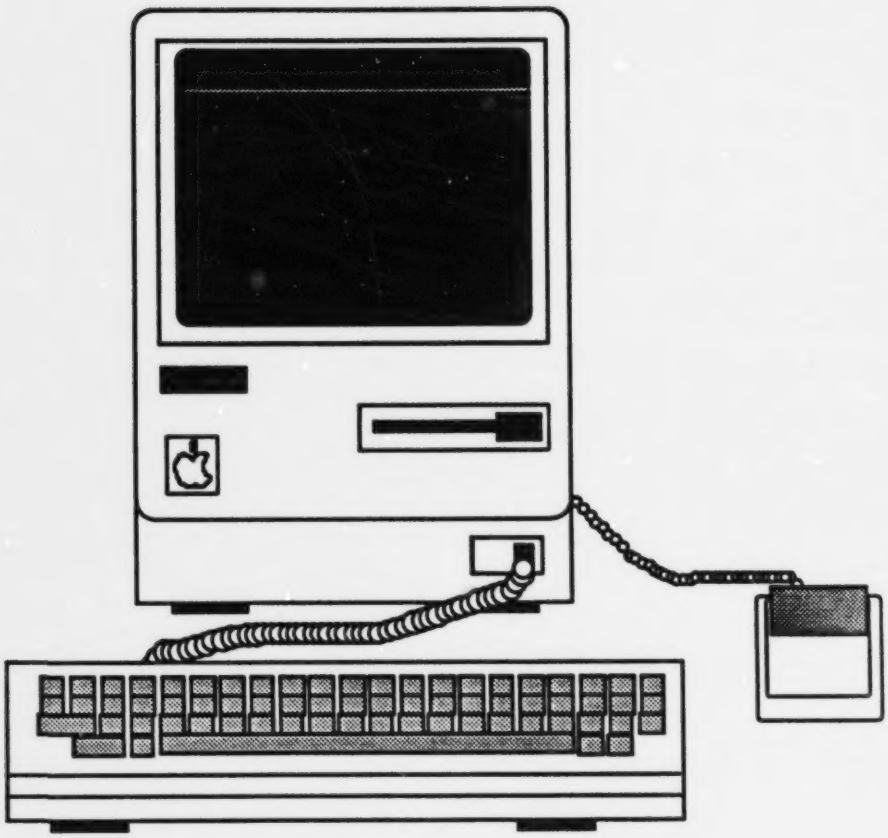
OPTION DELETIONS

STUB WALL C/OAK CAP	$900.00	OAK RAILS C/W BRASS	*	$900.00
STUB WALL C/OAK CAP	$525.00	MAHOGANY RAILS C/W	*	$525.00
BUILT IN MAGAZINE RAC	$100.00	NONE	*	$100.00
B/I WALL DESK	$1550.00	WET BAR		$0.00
PATIO COURT YARD	$1800.00	NONE	*	$1800.00
CEILING FAN	$220.00	NONE		$0.00
VAULTED CEILING BED & S	$175.00	NONE	*	$175.00
ELEVATION A	$850.00	ELEVATION B		$0.00
APPLIANCE PACKAGE	$1050.00	NONE		$0.00
LEGAL FEES	$225.00	NONE	*	$225.00
TOTAL SAVING		TOTAL		$3725.00

the ELITE specification is included in base price of house

the Classic specification is shown with the cost of the extra. Where a CLASSIC item is used a * is entered in this column and the cost is automatically added to the base price of the house

Fig. 22. Jayman Homes - List of Cost Options



CHAPTER SIX

CONCLUSIONS

6.0 OVERALL EVALUATION OF THE MARKETING STRATEGY

6.1 REACTIONS BY HOMEBUYERS & SALES PEOPLE

Contact with customers generally generated favorable comments on the use of computers for carrying out design modifications. The attached questionnaires (in Appendix B) indicate an overall favorable response, and suggest that the approach is a considerable improvement over conventional techniques.

The three main advantages were that the customer could quickly try out a variety of options and easily discard those that were not feasible, he or she was able to leave with a printed copy of the modified plan, and the sales person could quickly secure the contract with the customer without waiting at least a week for revised drawings.

There is some indication that the computer may well be suited to dealing solely with the changes at the initial stage and that the builder may choose to use conventional drafting techniques for the preparation of working drawings.

6.2 EASE OF OPERATION OF EQUIPMENT AND SOFTWARE

In the last few years computer and software designers have strived to make their new products more user friendly. In the case of the Macintosh the whole system is generally easy to use since there is always some degree of on-screen assistance available, the design of the various programs allows for a high level of consistent instruction modes, and the screen image looks familiar to normal traditional methods.

The ability to move information electronically around the system from application to application is straightforward. The portable nature of the equipment allows a great deal of flexibility in how the system is utilized. The use of standard menus and templates can allow the new user to move

confidently into the system.

Although not mentioned specifically in the surveys, the screen size does represent some degree of a problem which hopefully will be solved later this year, without costly additional hardware.

6.3 AMOUNT OF TRAINING REQUIRED

The overall impression gained from this study and the work in the author's associated architectural practice is that the system is easy to learn in the main drawing, spread sheet, and word processing applications, providing the student has original training in the subject area.

No firm conclusions were obtained on the degree to which a sales person might be able to make simple modifications to the plans. It is safe to assume that if a salesperson currently is responsible for making rough sketches of changes that he or she could certainly use the drawing program to advantage.

There is some degree of disagreement on the way in which instruction is provided. Should it be by way of good documentation or should the student be immersed into applications for intensive use? The second approach appears to have definite benefits providing there is always online assistance to show solutions.

With the Macintosh or any mouse driven system, hand and eye coordination becomes an important factor.

6.4 REFINEMENTS TO THE MARKETING APPROACH

It is too early to suggest any major modifications or refinements to the approach outlined in this study, until it is tested under a variety of circumstances and conditions.

6.5 EFFECTIVENESS OF SALES APPROACH

Perhaps the effectiveness of the system can be summarized as follows:

a) The system provides the ability to have all of the information required, in a compact and portable format, which can be taken directly to the homeowner.

b) There is a high degree of flexibility in providing the house design that suits a particular family's needs.

c) There is the ability to allow a range of other management services such as follow-up letters, a potential homeowner's database, etc.

d) The system permits closer contact with the "head office," to minimize mistakes occurring due to poor communications.

e) Sales material can be printed in a high quality format and changed at short notice.

f) The system can be used effectively by the smaller builder.

6.6 THE POTENTIAL FOR WIDER USE OF THIS COMPUTERIZED APPROACH

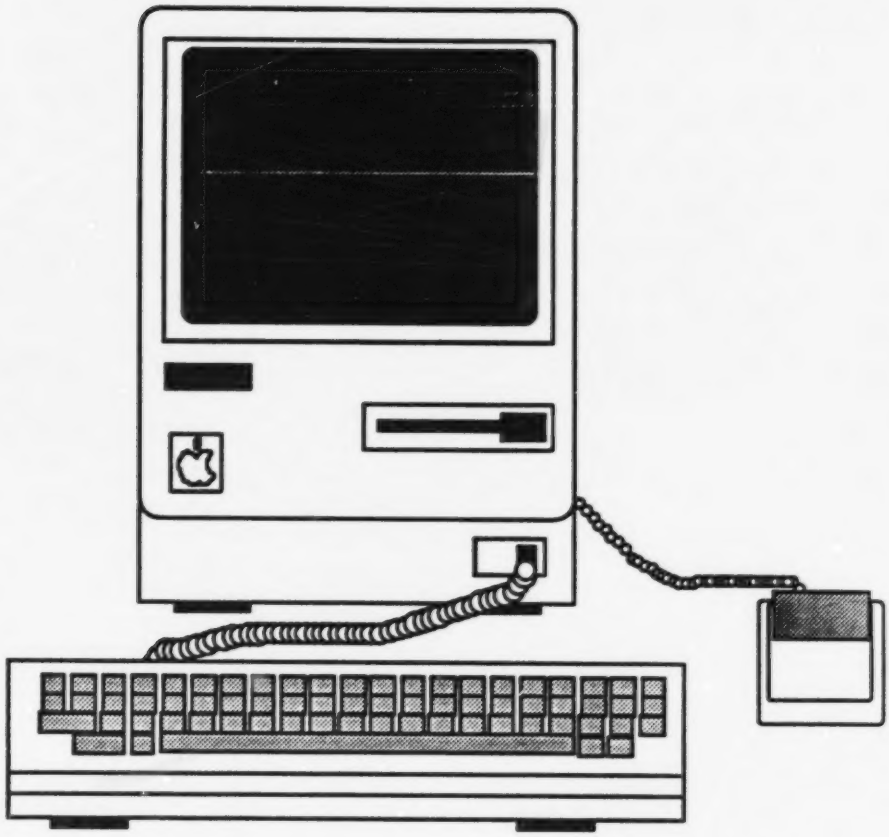
The key to the wider use of this marketing approach is that it is within the financial reach of the smaller builder, and can in addition to design and production drawings preparation, provide a range of additional services such as accounting, management and the preparation of sales information.

Greater use of the Macintosh system will only take place if there is a good accounting package available in a easily understood format. The indications are that several such systems will be available in the near future. Other factors that will encourage greater use will be the

introduction of more interactive programs where changes in one application will automatically be registered in another.

In the latter stages of preparing this report a number of people have indicated the potential for a network of building companies, perhaps organized in a franchise operation, who would share a range of standard plans that could be updated and supplemented on a regular basis, from a centralized source.

The last factor which will speed up the introduction of a computerized approach to the marketing and design process will be the increased input by the sales staff to improve the approach and content.



APPENDIX A

HARDWARE AND SOFTWARE

1.1 Introduction

The review of available hardware and software is potentially the most difficult part of this report, in that almost daily new items become available and seem to offer greater flexibility and integration with other options.

The question often asked is "Why should I buy now?--tomorrow will only bring out better equipment." The new Atari and Commodore computers have been very widely praised by experts. However, as yet they are greatly lacking in the type of software required for business use.

Likely changes to the size of screen and a more open computer architecture (unlike the sealed nature of the current Mac), and the introduction of colour later this year will do much to overcome the resistance to the system. Other developments by Atari and Commodore in the development of sophisticated multitasking systems (as yet untested) will hopefully encourage Apple to also develop systems which permit concurrent use of several programs, with built-in print spooling, etc.

Indeed, the Macintosh has only just reached a stage where it can truly be counted as a machine suited for the business environment, mainly due to the introduction of meaningful and "bugfree" software. The major disadvantage currently is one of screen size which makes it difficult for more than two people to see the screen, and tends to give the impression of a toy. While these must be judged against the portability of the system, there seems to be a strong indication that future options will include add-on screens to suit particular applications like drawings and word processing (i.e. horizontal and vertical formats). Where the expense is justified ($250.00 per day rental or a cost of $9000.00) and a large group must be catered to, a large screen projector unit specially designed for Macintosh can be used, providing the computer is fitted with a video card adapter.

1.2 Software

Software for the Macintosh tends to be very inexpensive when compared

to other machines. The main programs used in the development of this study and their current prices are summarized below :

1. **Macdraw** - a scaled drawing program produced by Apple Computers Inc. Cost approximately $185.00

2. **Microsoft Multiplan** - a well known spread sheet program with capability for exchange of information to the IBM version. Cost approximately $175.00.

3. **MacWrite** - a word processing program produced by Apple Computers Inc. Usually supplied with the Macintosh computer.

4. **Microsoft Word** - a word processing program produced by Microsoft Inc. which has more capability than Macwrite including mail merge facilities. Approximate cost $190.00.

5. **Switcher** - a program to allow fast interaction between programs. Produced by Apple computers and free to Macintosh owners.

6. **Desk Accessories** - these consist of a variety of mini-programs that can be called from any program for a variety of tasks such as diaries, calculators, telephone dialers. Recently our office has used the **Sidetrack** system extensively for diary and general administrative functions and found it extremely useful. The Sidetrack program costs less than $100.00.

Programs which have been tested successfully after the completion of the major part of the report and which represent a major improvement are:-

1. **Macdraft** - an improved drawing program which can rotate objects, permit zooming of images, and provide automatic dimensioning. The program can also be used in conjunction with Macdraw which still has some unique features. Macdraft is produced by IDD. Inc. and costs approximately $295.00.

2. **Excell** - a spread sheet program produced by Microsoft Inc. and currently regarded as one of the most powerful programs on the market.

Costs approximately $450.00.

3. **Macplot** - is a plotter utility which converts a Macdraw or other graphic image for most popular pen plotters. The program has been very limited in the size of document that can be handled, however the makers --Microspot Ltd. based in the UK--are close to providing a disk based program for plotters which will handle any size of drawing. This clearly will be a major step forward, in that the preparation of larger drawings represents one of the major difficulties with the approach.

4. **Macproject** - allows the user to use a combination of critical path scheduling methods with bar charts, cash flows, and a variety of project costings. The program allow very easy updating of information. Cost approximately $170.00. (See Figure 22. on page 55.)

5. **Three Dimensional Software** - Figure 23. on page 56 shows a three dimensional program developed by the author. Various three dimensional programs are in the developmental stage and should be available shortly.

These later programs whilst adding to the capability, do however place much higher memory requirements on the computer and cannot be used productively without a minimum of 1 MB of memory and a 10MB hard disk.

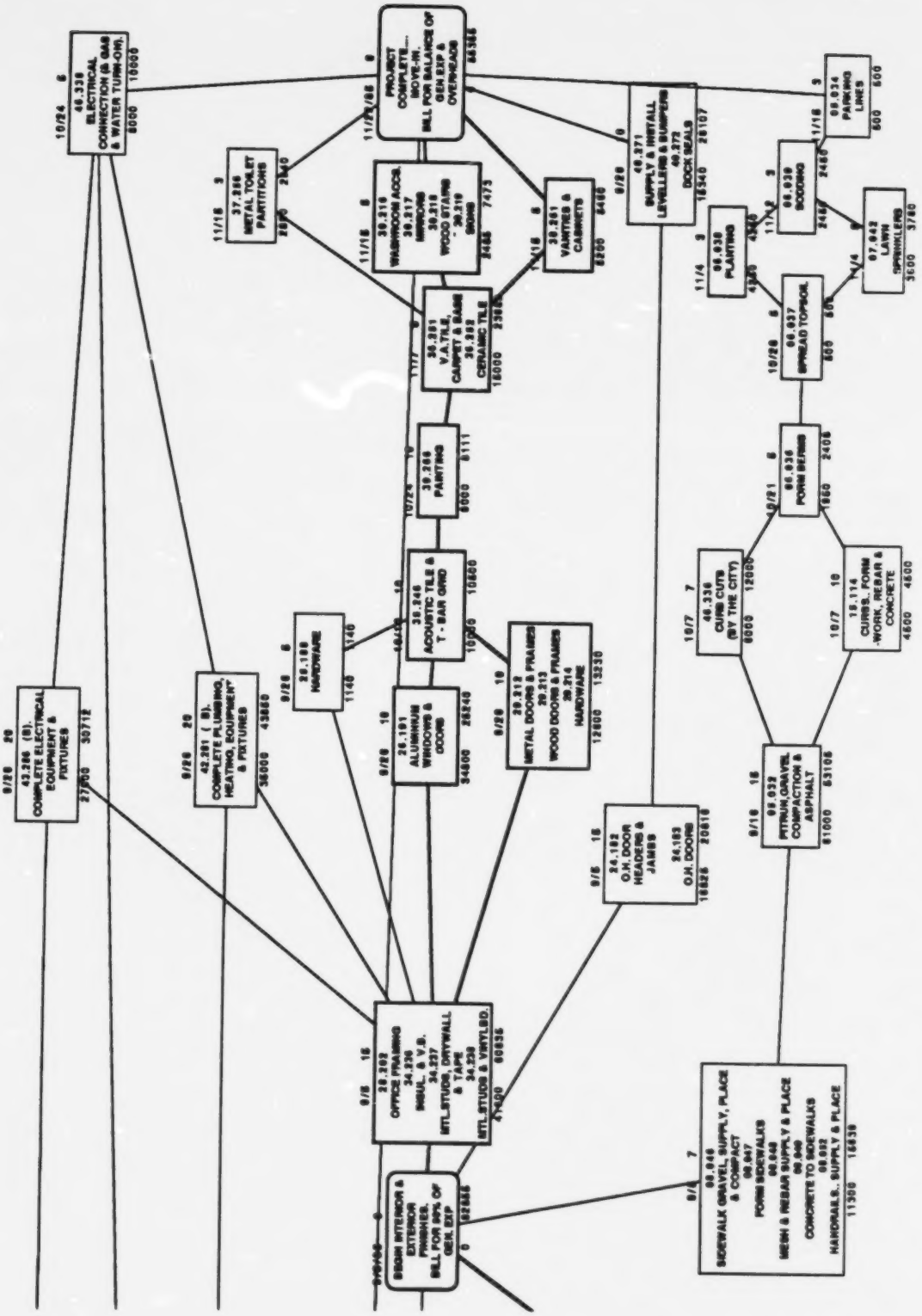


Fig. 22. Macproject Critical Path Program

Fig. 23. Computerized Three Dimensional Drawing

5.3 Hardware

The main hardware used consisted of:-

1. **An Apple Lisa Computer** with 1 MB. of memory and an internal 10 MB. hard disk storage drive. This computer is no longer available, but secondhand versions are available at a considerable cost reduction from the original. The Lisa worked almost identically to the Macintosh, and has the advantage of a larger screen. It is also slower than an equivalent Macintosh, less portable and has no sound capability, but nevertheless represents a very affordable way of providing a network of computers. Currently, the cost of a second hand Lisa would range from $2800.00 for Lisa 2/5 to $4300.00 for a Lisa 2/10.

2. **An Apple Macintosh 512K computer** with an internal 400K disk drive and a second external 400K disk drive. This computer is fine for single applications but as soon as several applications such as drawing and spread sheet programs are introduced there are considerable time delays experienced. Excellent as a starter system. Screen size places some limitations on perceived use. Cost is approximately $3000.00.

3. **An Apple Macintosh 512K Computer** with an internal Hyperdrive 10MB. hard drive storage disk. This combination was the first of the very fast Macintosh systems--reducing access time for programs and files by 80% over the conventional machine. Normal 3-1/4" storage disks are only used for backup purposes. The machine also allows a very high level of portability with an average setup time of only a few minutes. Cost of the combined unit is approximately $6000.00.

4. **11" & 15" Apple Imagewriters.** These provide the main method of printing both graphics and text documents. Larger drawings can be assembled by obtaining photocopies of composite drawings. Cost approximately $850.00 to $1100.00. The later Imagewriter 2 now offers the use of colour and an auto loader for single sheets.

5. **The Apple Laserwriter.** This unit provides very high quality results in both letter and legal sizes. The end effect in both graphic and text

formats is very close to type set quality. Text documents can be produced in a variety of fonts and are very fast to produce. Graphic documents are much slower depending on the complexity of the original design.

The Laserwriter can also act as the central unit for tying in a number of Macintosh and/or Lisa Computers into a basic network. The cost is unfortunately high at $11,000.00 but several companies in both Edmonton and Calgary are now offering printing services at about $2.00 per page.

Later hardware developments have included a recent introduction of the Macplus, a Macintosh computer with 1 MB. of memory and an internal 800K internal disk drive (at a cost of $4100.00), the Apple and Hyperdrive 20 MB. hard drive disk drives (at a cost of $2200.00 and $3000.00 respectively).

The Macplus computer includes a number of enhancements to the ROM (read only memory) which improve the speed and handling capability significantly. Developments expected later this year include larger screen formats and a more open "architecture" to enable third party hardware developers to interface with the machine.

Significant developments are also expected in the area of networking. This is the system which, when combined with a large capacity file server, allows full integration and communication between a number of computers for access to common files and applications including electronic correspondence.

Some testing has taken place in the area of transfer of documents and drawings over telephone modem links. Generally this was found to be very satisfactory except that higher performance modems are required in the 2400 Baud rate in order make the transfer take place in a reasonable time frame.

It is recommended that the introduction of computers into a business environment is done on a progressive basis with sound professional advice being obtained at all phases.

This may entail trying several systems on a trial basis before making a final commitment. Currently no systems appear to match the Macintosh as a good all round graphics/word processing/number crunching computer.

Interestingly the most difficult question facing most users is not what system or software to buy, but how many computers will be needed for serious and professional use, and how long will it take to effect the change over to a computerized system.

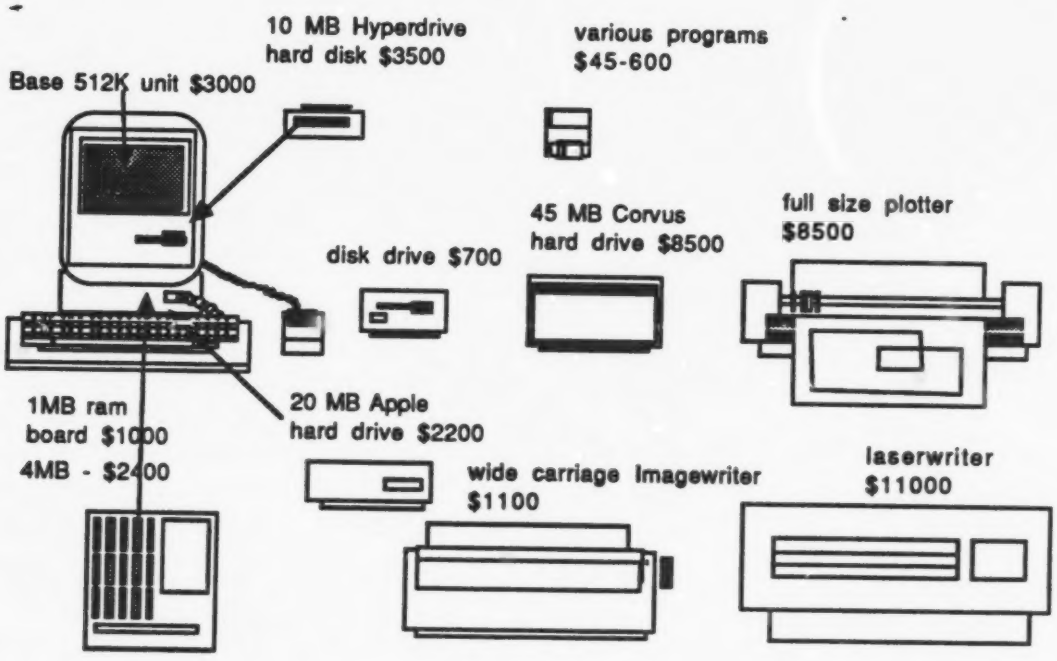
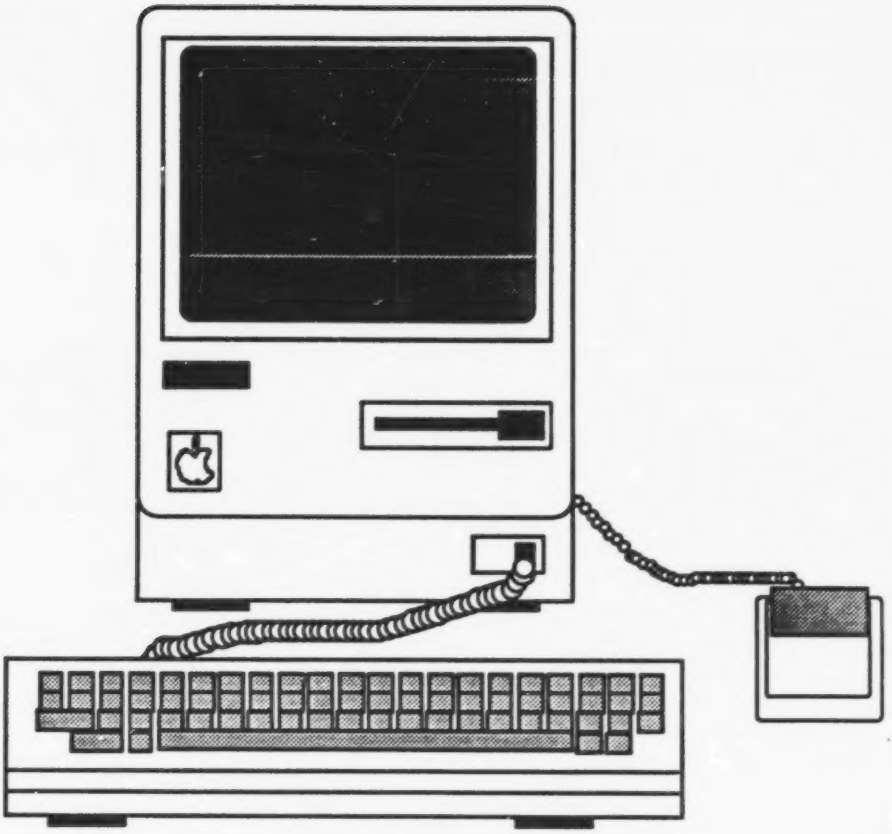


Fig. 24 Equipment Options and Costs

Costs will vary with the level of system acquired. For a base system including a printer and programs, expect to pay $4200.00; for a more advanced system with a 10 MB. hard drive add $2200.00. It is suggested that for any type of computer system, plan to budget over a one year period for at least two computers.



APPENDIX B

HOME OWNER SURVEYS

FUTURE VISION

computer aided design/programming/marketing
1403 - 2nd Street S.W. Calgary, Alberta,
Canada. T2R 0W7 tel (403) 263 6167

The purpose of this questionnaire is to gauge the reactions of home buyers to the use of computer graphics in the design & marketing of homes.

1. Date JANUARY 28/85
2. Builder ACACIA
3. Name L.W. KERR
4. Address #3 STRATHAVEN CIRCLE S.W
5. Phone# 242-8803
6. Are you familiar with computers ? YES
7. Are you familiar with construction drawings ? - SOMEWHAT
8. Did the computer assist you in exploring & making changes ?
   YES
9. Did the computer assist you in understanding the plans better than conventional drawings ?
   No - it did improve the turnaround time on changes and it therefore allowed us to experiment with more alternatives.
10. Did you find the furniture placement useful?
    Didn't use
11. Did the automatic dimensioning help?
    Didn't use
12. Was the screen size a limitation ?
    No
13. Any other comments or suggestions (please use rear of form if necessary) ?

FUTURE VISION

computer aided design/programming/marketing
1403 - 2nd Street S.W. Calgary, Alberta,
Canada. T2R 0W7 tel (403) 263 6167

The purpose of this questionnaire is to gauge the reactions of home buyers to the use of computer graphics in the design & marketing of homes.

1. Date December 11/85
2. Builder
3. Name Gayla Rogers
4. Address 2011 Parkside Rd SW
   Calgary
5. Phone* 281-6653
6. Are you familiar with computers ? No
7. Are you familiar with construction drawings ? Minimally
8. Did the computer assist you in exploring & making changes ?
   Yes
9. Did the computer assist you in understanding the plans better than conventional drawings ?
   Yes
10. Did you find the furniture placement useful?
    Yes
11. Did the automatic dimensioning help?
    Yes - very much
12. Was the screen size a limitation ?
    Not in my initial sketch
13. Any other comments or suggestions (please use rear of form if necessary) ?

Future Vision Computer Systems Ltd.
Computer Aided design/programming/marketing
1403 - 2nd Street S.W. Calgary, Alberta
Canada . T2R OW7 tel. 233-SOFT or 263-6167

QUESTIONAIRE ON COMPUTERIZED MARKETING/DESIGN APPROACH

1. DATE December 2 1985

2. BUILDER ACACIA Developments Ltd.

3. NAME Tom Hall & Norreen Baker

4. ADDRESS/PHONE * 2540 - 32 Ave S.W. T3E OV8
249-2839

5. ARE YOU FAMILIAR WITH COMPUTERS Elementary working knowledge only

6. ARE YOU FAMILIAR WITH CONSTRUCTION DRAWINGS No

7. DID THE COMPUTER PROCESS MAKE THE DESIGN CHANGES/OPTIONS EASIER TO UNDERSTAND? Most definitely

8. ANY OTHER COMMENTS WOULD BE APPRECIATED ON COMPUTERIZED APPROACH

It superb assist to design changes. I appreciated the accurate measurements. I could better visualize the total effect ie. placement & size of windows & doors. It was great to look at design changes then store them, recall them and/or change them.

The computer printout was amazing & so accurate & fast.

Ideas for furniture placement were explored and most helpful. Amazing! We would have spent several days & perhaps not have arrived at such

an accurate drawing.
We were impressed! Thank you for your help.

M. Baker
Tom B. Lee

We highly recommend this process for all new home builders.